GSI Through Lenses
Antiquity Revisited

GEOLOGICAL SURVEY OF INDIA
KOLKATA
2014

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ANTIQUITY REVISITED

GEOLOGICAL SURVEY OF INDIA
CENTRAL HEADQUARTERS
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2014

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FOREWORD

The Geological Survey of India (GSI) narrates its own story from inception and development, activity and expansion, discoveries and success through its hundreds of printed documents. The agony and ecstasy of the working geologists of the yesteryears are recorded in the reminiscences and memorabilia. The huge stock of photographs preserved as repository in Central Library is the testimony of observations of the geologists and their understanding of materialistic and emotive aspects and love for nature. The Earth writes its own story in the foliages of rocks. GSI had no such perfect repository to tell its story. Attempts were made earlier in different occasions to compile, to collect and collate from different places such invaluable depictions created by the doyens of GSI.

Prior to the introduction of camera and films, during the survey and exploration the enthusiasts used to draw sketches whenever and whatever they observed and felt. Such line drawings were sometime to record the hard facts of the geology and sometimes to tease others or to amuse themselves.As geologists we are naturally sensitive and know from our own experiences that there is a whole world beyond what meets the naked eye. Geologists' emotional sensitivity is a blessing that propels creativity and abiding relationship with splendours of earth. This volume of field pictures, sketches and maps focuses on our need to foster attitude towards surrounding environment, to the world, to our own actions and the repercussions of these actions and help rejuvenate our innate energy system in the process. With this volume of rare collection of photos and images we rejuvenate ourselves to be anchored in solid core values, proud of our past accomplishments, yet fully capable of proposing, testing, implementing and promoting creative solutions for tomorrow. This volume will help to refresh our spirit to meet the emerging challenges of modernized GSI having vision to become world class geoscientific organisation.

GSI has an archive of nearly three thousand photographs of valuable interest. The work is going on to digitize them. Temptation is such a thing that it is difficult to suppress for a noble cause. In fact, the idea of making a pictorial documentation of GSI's history through archived photographs was conceived during the visit by Shri D.S. Mishra, Joint Secretary to the Government of India, Ministry of Mines to the Central Library in February 2013. While sifting through some of the photographs, he requested the then Director General Shri A. Sundaramoorthy to have some of them meaningfully arranged within a single cover in the form of a coffee table book. This publication ***GSI Through Lenses- Antiquity Revisited*** is the outcome of such a concept and approach. The story builds up enticing with the archaic photographs restricted till thirties of the last century.

In order to preserve the heritage and also to popularize Geoscience and the activities of GSI, the idea of this publication has been fructified. Shri Arunabha Das has taken great pains in selecting the photographs from the archive. Shri Amitava Bandopadhyay, since superannuated was given the responsibility to arrange visuals with appropriate captions. S/Shri Nirmal Dhar, Basudev Roy and S.S. Dutta assisted in the production while S/Shri Rajeev Srivastava and Prabir Kumar Mondal supervised completion of the project in record time.

Publishing of the Coffee Table Book on ***GSI Through Lenses- Antiquity Revisited*** is part of the series of such user friendly endeavours of GSI launched since January 2014 viz., **(1) Indian Meteorites, (2) The Siwaliks- the Tale of Rising Himalayas, (3) Himalayan Glaciers, (4) Glimpses of Deccan Volcanics- Characteristics and Landscapes, (5) The Quaternary Plains of Punjab-an arena of Geological and Anthropogenic processes and (6) Thar Desert Landforms etc.** With this endeavour we also invite all to share our passion for understanding the natural world, and that all-consuming sense of mystic which drives us into an even deeper understanding of it. From ignorance to science and from spontaneity to consciousness, there is an endless progression. I sincerely hope this effort will be appreciated by one and all.

25/6/2014

Dr. Sudesh Kumar Wadhawan
Director General

I have strained my ears,
Opened my eyes,
And poured my heart out on earth.
I have searched for the unknown
Within the known.
In wonder, whereof, gushes forth my song.

— Rabindranath Tagore

Prologue

Geological Survey of India besides many other gems in her proud possession also has over three thousand glass negatives captured by geologists of GSI of nineteenth and early twentieth centuries. Those have been revisited recently. The photographs provide an insight to the rural Indian subcontinent depicting at once the hardship of life and the picturesque Nature during that bygone era. It is imperative that the public at large should be made aware of such treasure of archival value. This publication unveils more than hundred of such jewels to bring awareness among those who would care to make use of our hitherto veiled-repository for historical research.

The photographs in this publication were snapped during the height of Raj when world was passing through great industrial revolution. The societal imbalance in the culture and wealth under the roof of one and the same Nature is exquisitely visualised in these frames that is too apparent to miss though at times a trifle melancholic. They appeal to our senses without being demanding. Silently we appreciate the truth, the dichotomy and the beauty of Nature.

This story-line of Geological Survey of India (GSI) is the history presenting in the form of story, rather pictorial story built up on some archaic photographs. The figures are of the photographs of some great events of the geological past and of the historical "present" recorded by the working geologists of GSI during the course of field work in the past across pan-Indian subcontinent stretching from Afghanistan in the west to Burma in the east. The wits of the British geologists who were far away from home have been captured from the 'windows' of their invaluable notebooks pencilled during the hardships of the fieldwork just to amuse themselves. These photographs and sketches speak a lot of the geology and its environs, life of geologists and above all the sense of capturing a frame that itself is a story of the history.

Let these archived figures be honoured as "Heritage".

Writing history of the Geological Survey of India is not as simple as the task for the Geological survey of Great Britain, as presented by Sir John Flitt, for the very good reason that whereas in the case of Great Britain the territory covered has remained constant, in the case of India, it has varied due to the remorseless operation of historical causes first expanding and later contracting between 1851 and 1947.

— **G.L. Fermor**

Geological Map of India covering Afghanistan to Burma (End of 19th century ?)

The Prelude

The development of geological sciences in India happened through the trading company of the British the East India Company mainly in the interest of exploring and exploiting coal principally for navigation.

At least half a century before the Company took over to rule India after the battle of Plassey in 1757, Basavaraja of Keladi mentioned in his encyclopaedic work *Sivatattvaratnakara* (1709) on the locations, quality, brilliance, defects and classes of some precious stones like diamond, pearls, rubies, blue stone, emerald, quartz, topaz, onyx, amethyst and coral including the methods of distinguishing between natural and false.

Fossils of old workings and metal smelting dotted all over the country are the muted testimony of India's mining and metallurgical achievements in the medieval period. Marco Polo described about the methods of diamond mining of 13th century in India. Lord Clive visited diamond mines at 'Sumbhulpoor' and described "mountains abound with gold and diamond".

A view of volcano on Barren Island (1789)

Fig.2. A sketchy view of Barren Volcano erupted in 1789 Ref. : "Jungle Life in India"

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Prior to shipping to India, the Company selected mostly the best knowledgeable and successful working young 'gentlemen' in its own country from all disciplines and put them under preliminary knowledge on natural science. So there were a number of documents published in different journals of India and Europe on occurrences of coal and minerals, old workings and fossils etc from these 'gentlemen' with different professions.

Copper was discovered in Nellore district in 1801. Dr. Francis Buchanan, a Scottish physician, made significant contributions in describing the rocks of south Indian temples completed with descriptions of minerals while living in India. He also mentioned about the collections of gold dust in river. Geological occurrence of minerals, rocks, and smelting of iron has been detailed by Dr. Benjamin Heyne in his classical report in 1814.

Centuries before Wegener's plate tectonic theory, Capt. Wilford theorised India was an Island separated by a sea from Himalayas.

First attempt to commercial exploitation of minerals in India initiated in 1774, particularly for coal after discovering six mineable zones along Damodar river. Prince Dwarakanath Tagore, as a principal partner of M/s Carr, Tagore & Co., got associated with this business of coal mining in 1835.

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Dr. Henry Westly Voysey, regarded as the father of Indian Geology, was associated as a Surgeon with the Great Trigonometrical Survey during 1818 to 1823 mainly because of his knowledge in geology. He completed the first Geological Map of Hyderabad Region along with a detailed sixty-page report. He was found dead in a *palki* on his return journey from Nagpur to Calcutta on 19th April 1824.

Captain F. Dangerfield of Bombay Native Infantry was a Scientific Officer in Central India during 1820-1821 and his report on the Geology of Central India was referred later in Malcom's Memoir. He also published a map of a part of India after Voysey's demise. On appreciating his dedication and knowledge in geological science, he was given the charge of conducting mineralogical and geological investigation in Himalayan Region but his poor health cut short his study and he resigned. Captain J.D. Herbert took over the charge as Geological Surveyor of the Himalayan Mountains and his excellent work brought several papers in a span of six years [fig.3].

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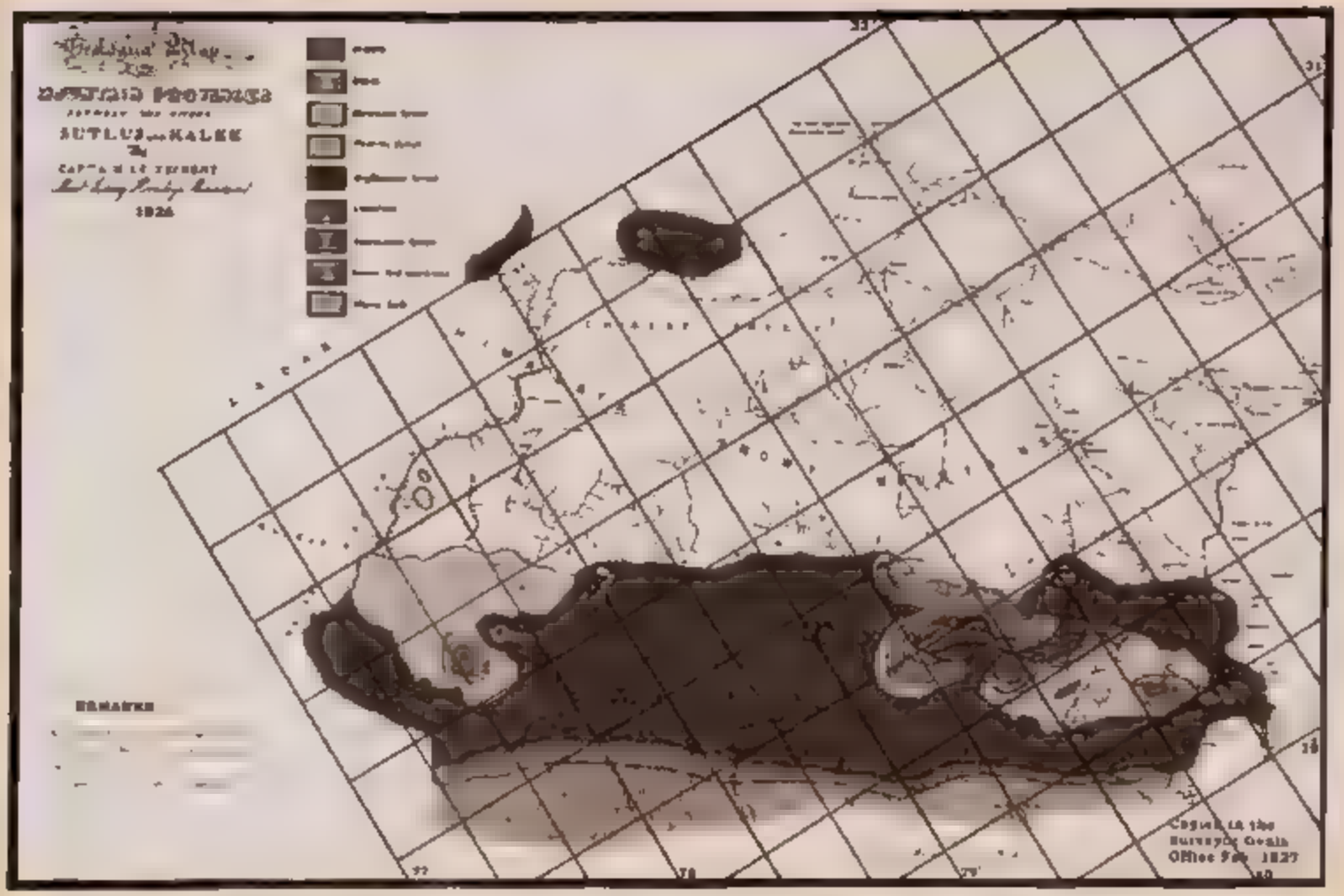

Fig.3. Map of Sutlej area, Himalaya by Captain J.D. Herbert 1826 (Journal of the Asiatic Society of Bengal)

John McClelland was instrumental in making the East India Company convince about the importance and compulsion of systematic geological study in India for the sake of economic exploitation of minerals and coal.

Coal, being an important commodity, got immediate attention of McClelland's suggestion. The Company formed a Committee for the investigation of coal and mineral resources in December 1836. McClelland, the Secretary of the Committee, worked till 1845. He submitted his first report in the year of initiation itself mentioning the list of major coal occurrences namely, Raniganj, Damodar, Rajmahal and Pilamou in Bengal fields, Norbuddah valley, Chanda and Wardha, the Mahanadi vally, Assam, Sylhet and Burma. Later he submitted more reports citing some occurrences of mineral deposits along with maps. [fig.4. Plant fossils sketched by McClelland].

McClelland had played significant role for the appointment of professional geologists. To his dismal frustration, his recommendation was initially turned down by the government but his dogmatic tenacity in persuasion and persistent efforts ultimately worked. The Court of Directors of the Company appointed D.H. Williams, having a background of six years experience in geological investigation in the Geological Survey of the United Kingdom, as the first Geological Surveyor in 1846. His joining report is still an exhibit substance in the history of GSI [fig.5].

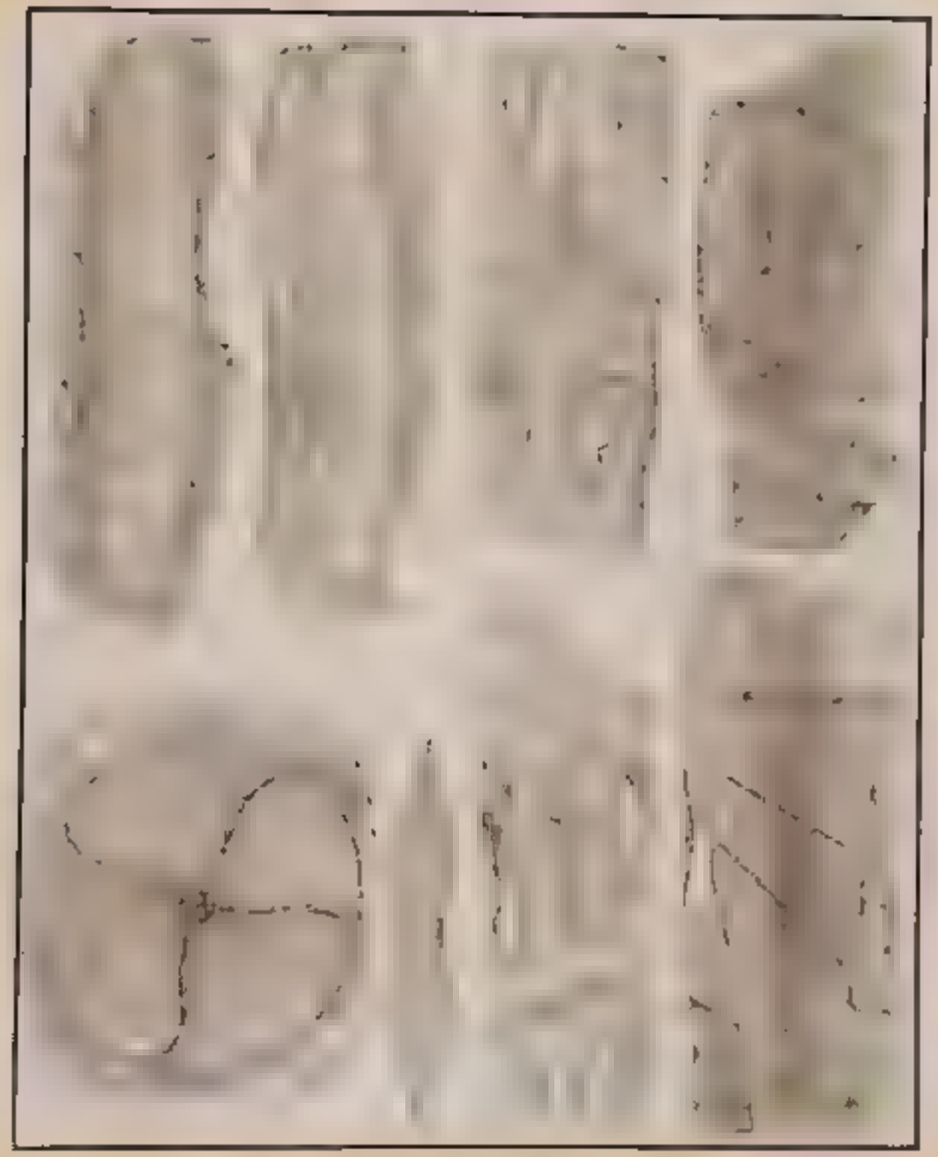

Fig.4. Plant fossils sketched by McClelland

Williams' arrival in Calcutta made a great impetus in undertaking the detailed geological survey in different coalfields. He intended to collect as much information as possible on coal and other mineral potential and started writing reports on the progress in the investigation from the field itself [fig.6]. During initiation of work at Karanpura Coalfield in the field season 1848-49, he fell ill with jungle fever and expired at Hazaribagh on 15th November 1848. He first introduced GSI logo and it has been changed with time [fig.7].

Incidentally, on the same day one of his two assistants who were medical students died in a palanquin en route to the camp. McClelland was soon appointed as "Officiating Surveyor" to take over the charge in the field and advised to investigate in the Barakar Valley instead of Damodar, that promptly led in the discovery of Karharbari Coalfield. He made a map of this area on 4 inch to a mile scale. On his resignation on 1st April 1850, the establishment was put under the charge of Deputy Governor General, Captain Thuillier in a dormant state till the Geological Survey of India was born as a formal geological establishment under supervision of a very competent and experienced geologist Sir Thomas Oldham in 1851.

GSI still remembers Voysey, Williams, Brade Jones and Johnsons whose valuable life and work during those days of real hardships in the land of jungles and wild animals got shortened due to untimely death on various reasons.

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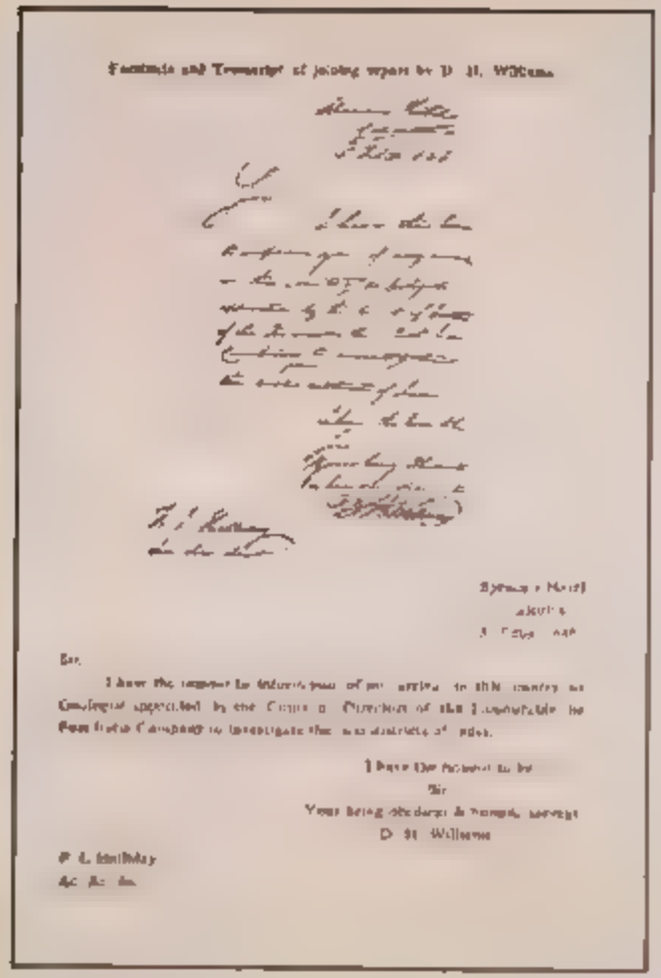


Fig.5. Joining report of Williams

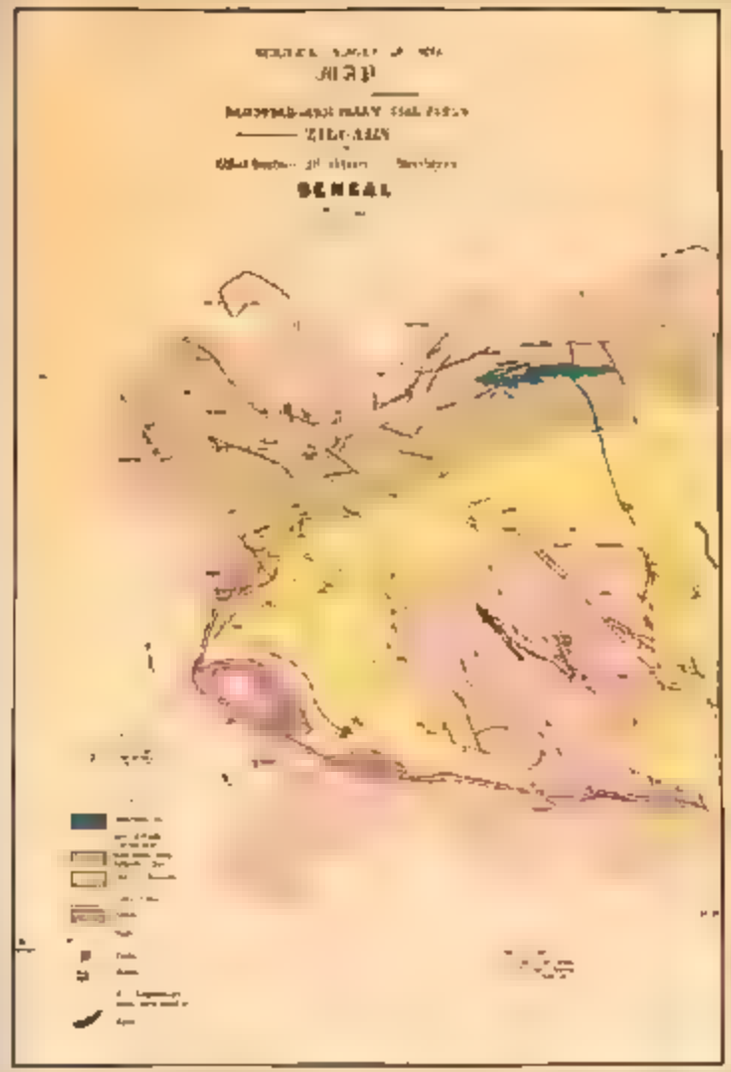
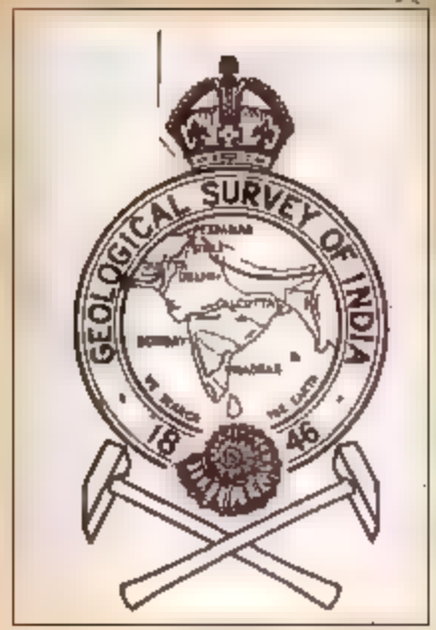


Fig.6. Williams' Geological map of West Burdwan, Manbhoom and Beerbhoom



1846

1924

1924

Fig.7. Logo of Geological Survey used at different time

And The GSI Is Born...

The arrival of Professor Thomas Oldham of Trinity College, Dublin and the Chief of the Irish Geological Survey at Calcutta on 4th March 1851 is marked the beginning of the continuous journey of the Geological Survey of India [fig.8]. This is the initiation of a new era for the organisation as well as for India. The geological sciences of the world got enriched with new discoveries of rocks, fossils and concepts while the country prospered with economy on exploration and exploitation of its huge mineral wealth.

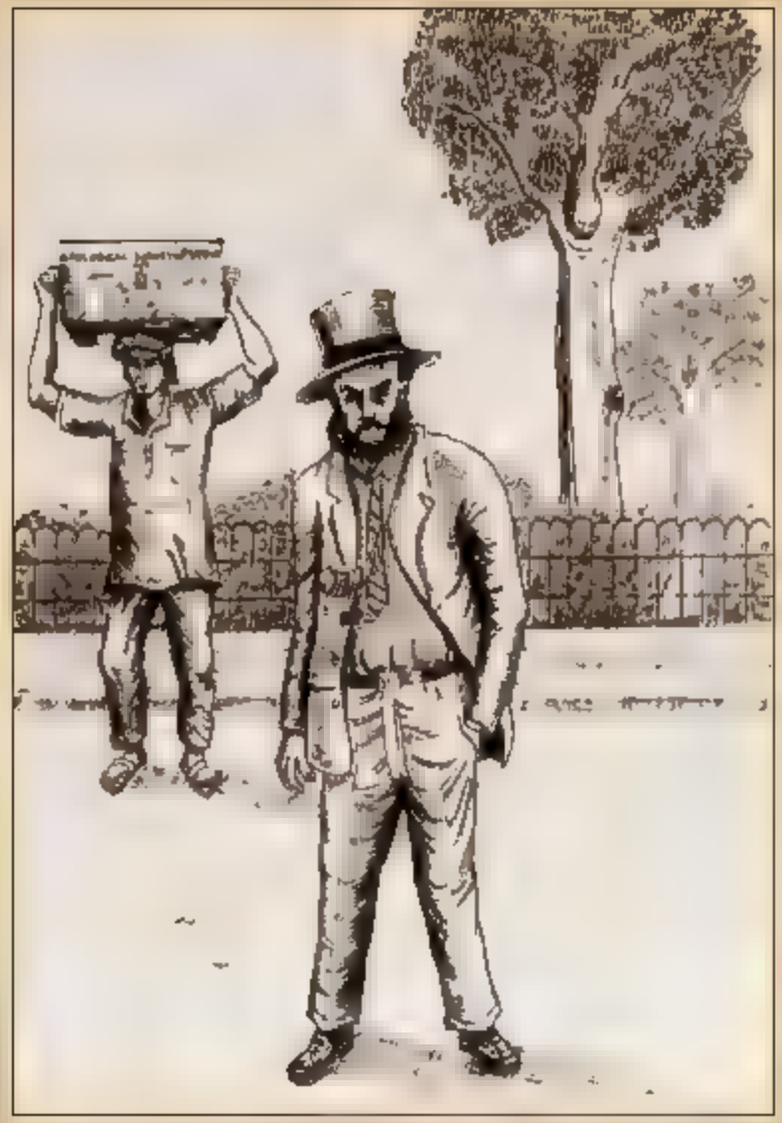


Fig.8. Arrival of Thomas Oldham

Fig.9. Sir Thomas Oldham

The Childhood

The appointment of Dr. Thomas Oldham [fig.9] as Geological Surveyor of GSI was on a five-year contract basis for a fixed monthly salary of Rs. 888/-. He started the survey work on a broader perspective wider vision embracing the whole country in a continuous and systematic way to prepare a geological map of India and also to give special attention on some detached districts for any special discovery or preparation of isolated maps and reports. First five years were devoted to search for coal in eastern and central India.

Dr. Oldham had masterminded the plan for growth of this organisation. In the best opportune moment, during the process of renewal of his contract for the second five-year term, he communicated (letter no. 68, dated 31.5.1856) to the Government of India with a note for consideration of "a general and uniform plan on which I would propose that the operations should in future be carried out....with a few propositions for the improvement and extension of our establishment and of our labours". With the demand of increase in number of sanctioned strength of officials he also proposed to introduce Geological Survey publishing of maps and publications in place of the then scattered publications, partly as Government Records, and partly in the Journal of the Asiatic Society of Bengal, Madras Journal of Literature and Science and elsewhere. His appeal was approved and GSI started its own serial publications in the form of Memoirs, Records and Palaeontologia Indica [fig.10-12]. As the power was transferred from the East India Company to the British Raj in August 1858, Lord Canning, the first Viceroy and Governor General, announced head of GSI as Superintendent.

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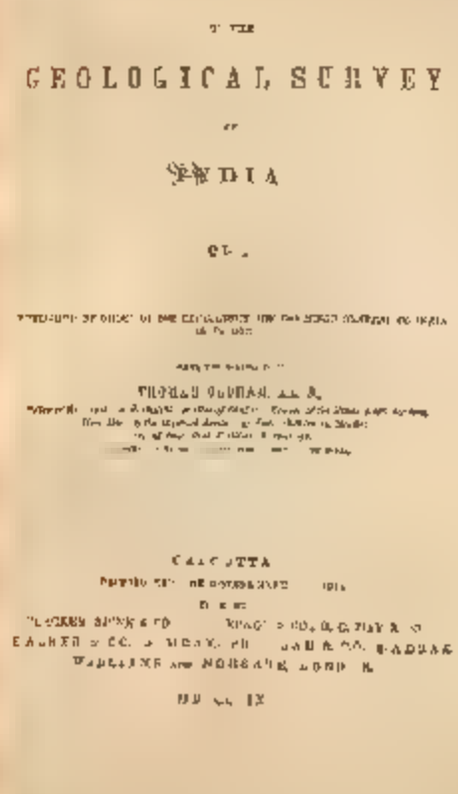

MEMOIRS
OF THE
GEOLOGICAL SURVEY
OF
INDIA

Fig.10. Cover of Memoir

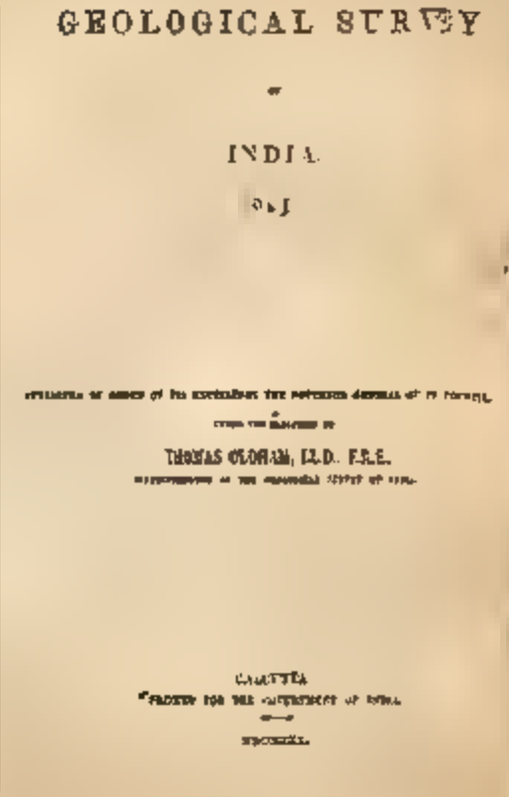

MEMOIRS
OF THE
GEOLOGICAL SURVEY OF INDIA

Palaeontologia Indica.

1 The Fossil Cephalopods of the Cretaceous Rocks of Southern India,
Geological Survey of India.

CALCUTTA.

Fig.11. Cover of Palaeontologia Indica


RECORDS
OF THE
GEOLOGICAL SURVEY
OF
INDIA.

THOMAS OLDHAM, LL.D. F.R.S.

CALCUTTA

Fig.10. Cover of Records

Oldham made his office at 1, Hastings Street, Calcutta in 1851 [fig.13]. In the same year the Museum of Economic Geology, set up with Asiatic Society in 1841, was handed over to GSI. Later he became the President of the Asiatic Society of Bengal.

He purchased some vertibrate fossils from Professor Von Klipstein for reference set for the Indian Museum, still known as Klipstein collection. These were in addition to the collections of rocks, minerals and fossils from field by GSI. He also added numerous collections of fossils from various sources in Europe, many in exchange for Indian ones. Like many museums of natural history and science, GSI displayed its collection in the gallery of the Indian Museum in Calcutta. [fig.14,15 & 16]

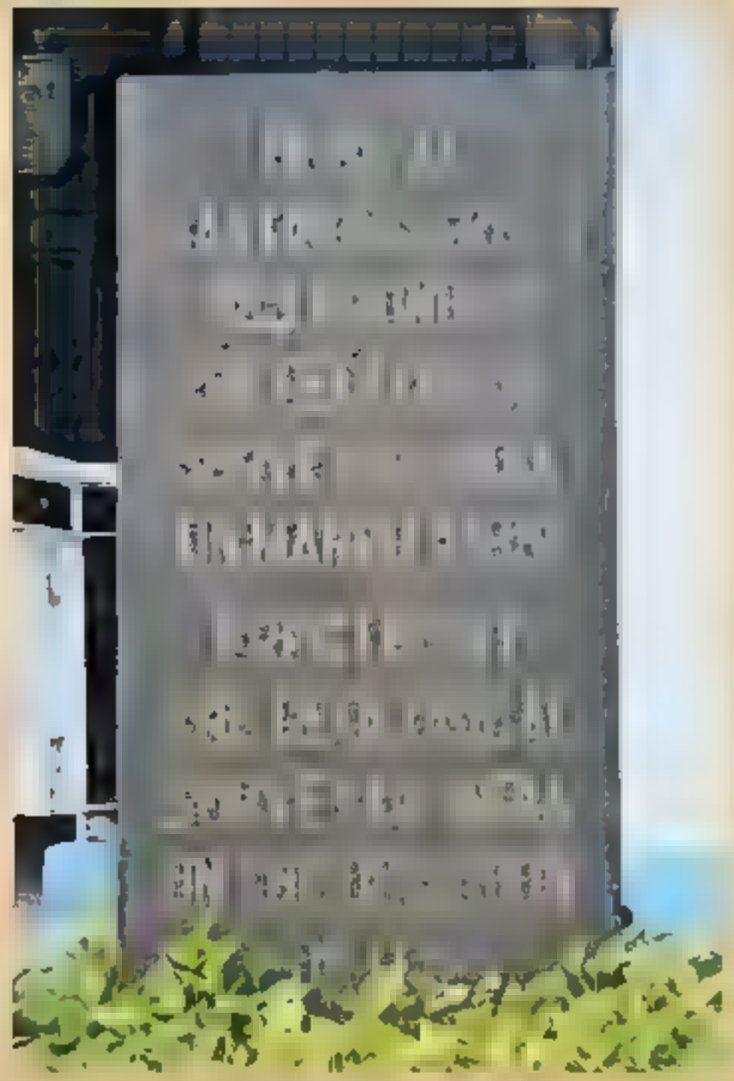


Fig.13. The plaque

Fig.15. Siwalik Gallery

Fig.14. Mineral Gallery

Fig.16. Invertebrate Gallery

It initiated with the purchase of entire meteorite collection of Professor Robert Philip Greg by the Government of India in 1865. In 1867, Oldham made the third catalogue with 258 falls and finds in the series of collections and published; the first catalogue was prepared by him only in 1864 with collections of 21 stones and 26 irons. In 1868, these were amalgamated with the specimens under the possession of the Asiatic Society of Bengal and later augmented by Indian falls officially received and by donations and exchanges. Now GSI is the custodian of all meteorite falls in the country [fig.17].

With the increase in strength of officers from 7 to 14 during 1856-1861, the geological work spread from Bengal and adjacent parts to far off to Nilgiris in the south to Himalayas in the north. In regard to the survey of Coalfield in Bilaspur, he wrote a letter to the Under Secretary, Govt of India dated 28 December 1869 [fig.18].

He had made a strong team of experts with the cream of geologists of Britain like William King, C.A. Oldham, Robert Bruce Foote, Fedrick Richmond Mallet, Richard Trench, Frances Fradan, Charles Augustus Hacket, Theodore W. Hughes, Ferdian Stoliczka, Richard Lydekkar, Ottokar Fiestmantel, H.B. Medlicott and W.T. Blanford [fig.24 & 32 Team of Oldham].

Fig.17. Meteorite fell at Brindaban, 1925

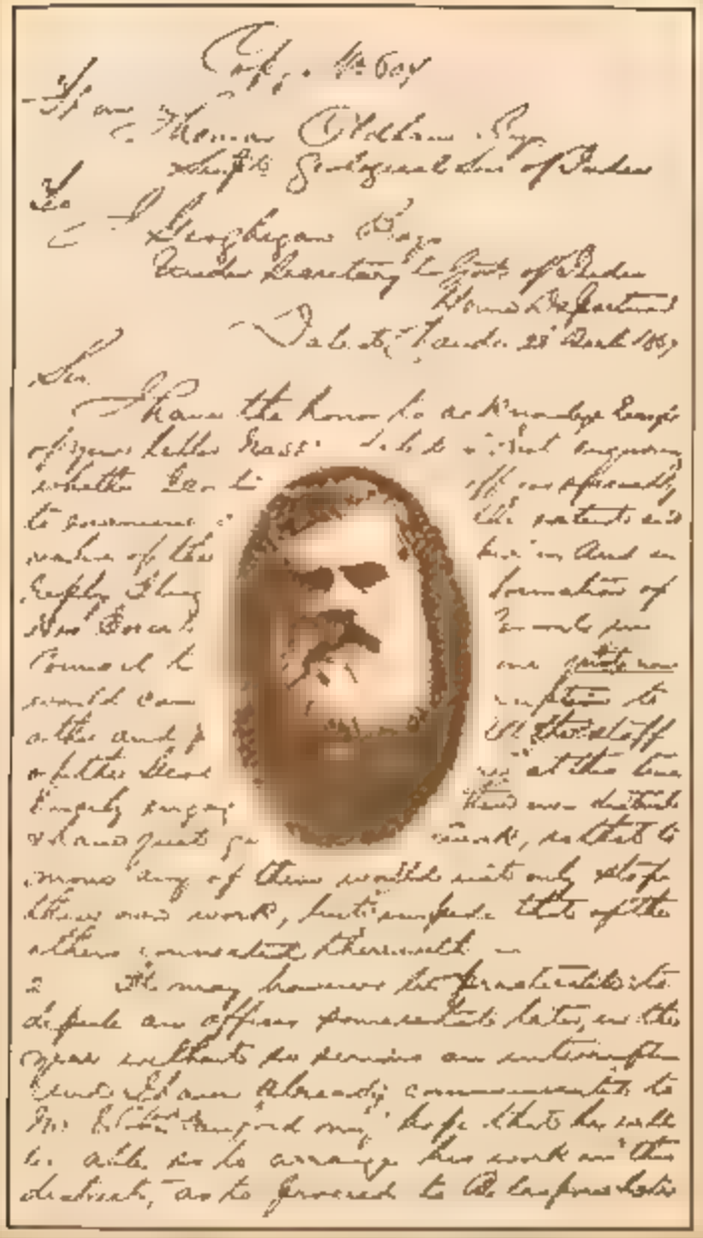


Fig. 18. Letter of Thomas Oldham, Sperintendent, GSI to the Under Secretary, Govt of India, dated 28 December 1869

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The Playground : Field Camps

In earlier times large tents were used and a normal amount of transport was 5 to 6 bullock carts or a string of 10 camels, elephants, horses and coolie. The entourage party was as well large with adequate cart or camel drivers, khalasis, mahuts, private servants including women and children. The GSI built up its own herd of elephants and horses. Officers set out for camp from Calcutta by road with their baggage on elephants/ camels/ bullock carts and themselves mounted on elephants or horses. Sometimes palanquins or *palkis* were used to carry them in field areas [fig. 19. Geologist at field; fig.20. Geologist on Elephant - sketches].

There were sheds for the animals during the off field-season period. The elephants were trained to pick up the rock samples – original sample collectors. Some interesting and hilarious quotes on sample collections and field experience are mentioned below.

Our elephant was an excellent one, when he did not take obstinate fits and so decide as to pick up piece of stone when desired, and with a jerk of the trunk throw them over his head for the rider to catch, thus saving the trouble of dismounting to geologists.

___ Hooker recounting a journey in 1848 in association with Williams

[Fig.21. The Camp at 6 A.M. and 6 P.M. sketched by V. Ball, GSI, 1880]

Fig. 19. Geologist at field

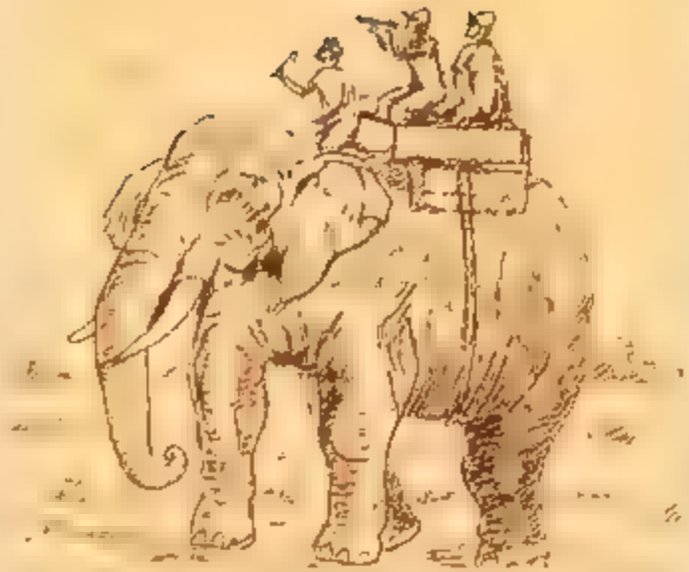


Fig. 20. Geologist on Elephant

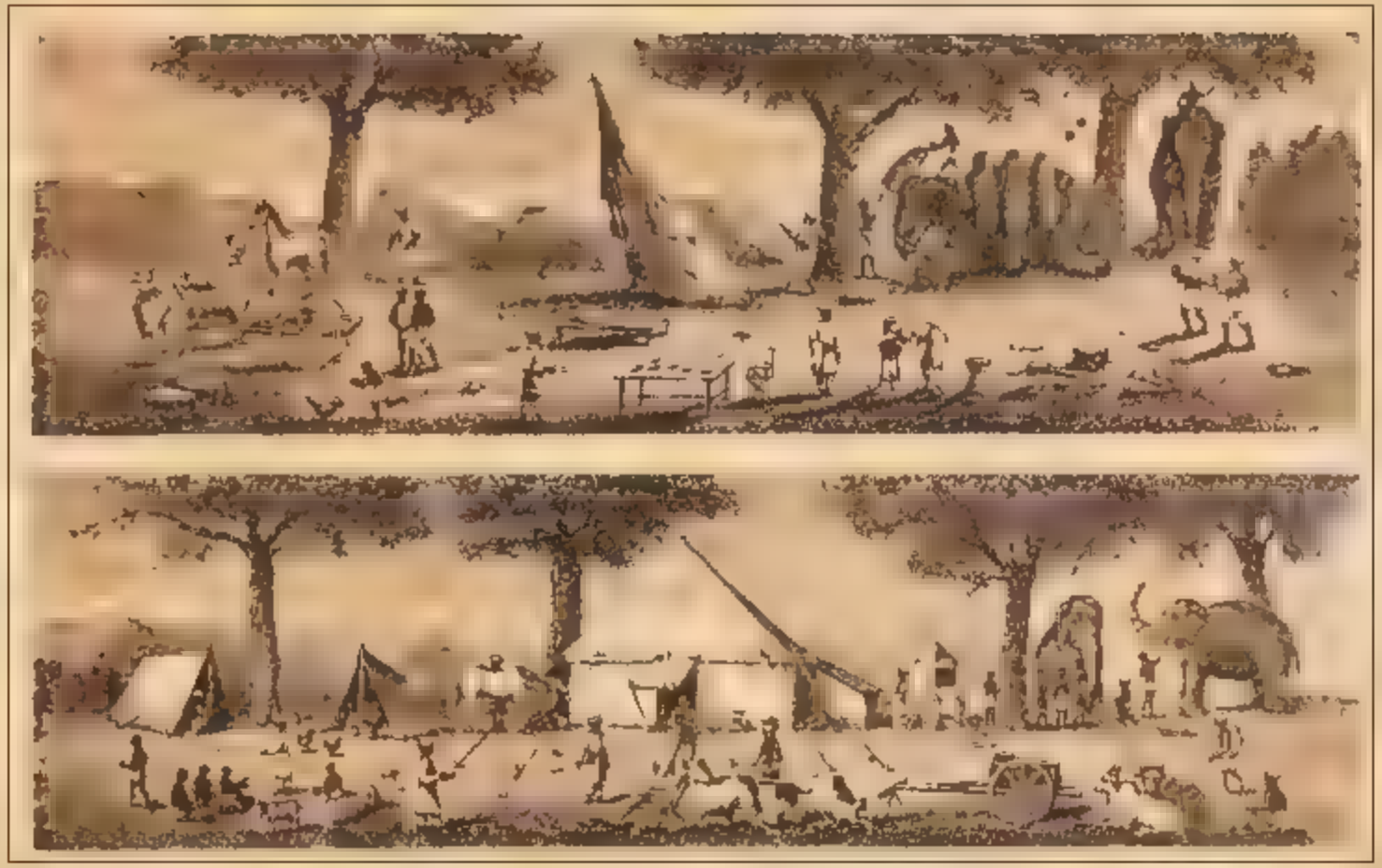


Fig.21. The Camp at 6 A.M. and 6 P M. sketched by V. Ball, 1880, (Ref. "Jungle Life in India")

Whilst crawling along a ditch looking for exposures under bushes, Gibson said that 'of course, this training would be of no value to us, as once we were in India we should ride on horse and survey with a telescope'.

___ G.L. Fermor reminiscing one comment of Mr. Walcott Gibson during their post-appointment training in Derbyshire in 1902

Heron said that he also looked in that direction and saw clearly a long line of dark boulders, and wondered how they could have missed noticing suc a characteristic outcrop. Any way, he pulled out his binocular and on focussing it saw that the boulders were moving slowly. It was a herd of buffalow.

___ C.S. Pichamuthu jotted down an amusing incident mentioned by Heron when his fellow geologist exclaimed during lunch time in the field that during mapping they had forgotten to notice a dolerite dyke in the valley below. On the same incident A.M. Heron, an excellent geologist who lived and died in India said, *Don't believe what you hear and half believe what you see.*

Thomas Oldham drew a number of sketches on happy moods of his colleagues after their return from field to headquarters. W. King and Robert Bruce Foote were his favourable models [Fig.22-23].

"Peaceful co-existence" - Sketched by Thomas Oldham

Fig.22. Bruce Foote and W.King in a happy mood after their return to headquarters – sketched by Thomas Oldham

Oldham's sketch - Tor modified to appear like a bishop's head

Fig.23. Tor modified to appear like a bishop's head – sketched by T. Oldham

In the Annual Report of 1863-64, Oldham recorded that up to date (in the last 17 years including those of Williams') the average longevity of geologists in the GSI was only a fraction more than nine years. In fact, the losses of the geological staff in its early years were so serious that Oldham recorded that Assurance officers declined to insure the lives of officers of GSI stating that no premium whatever could cover the risk.

Three basic qualities are needed to be a good geologist, namely guts and energy, power of observation, and common sense, failing which one should chuck of geology.

___ J.A. Dunn's prescription

All is well that ends well and on return to headquarters, we used to feel, it was after all not that bad and could be put up with.

___ A.K. Dey relieving his frustration after returning to headquarters from a field in wilderness for six months

Fig.24. Group photo

On many a occasions Oldham mentioned about the hardships of various kinds in carrying out the field work for geological investigations. Wild jungles, lethal malarial mosquitoes, wild animals, snakes were one type of impediments while language problem and hostile attitude of local people were of other kinds but among other main difficulties were non-availability of topographical maps and wide variations in the name of the villages, peaks, districts that were mentioned on the maps and pronounced by the local people. He appreciated Medlicott's effort in carrying out survey of 8000 square mile area geologically along with 2500 square mile topographical survey during 1856-57 and remarked, *European geologists seldom realise fully the difficulties which attend the steps of their brother labourers in this country. Districts without maps, without roads, without supplies, without inhabitations, meet you frequently.....Seldom is possible to return to the same place second time, to correct an error, or supply an omission. ...to fix accurately your position are not uncommonly source of confusion and perplexity, as you find the same peak known by different names on different sides, or by different people...*

The programme of field work got "dislocated" in 1857 during the Sipoy Mutiny. Theobold survived narrowly an attack in Mhow. J.G. Medlicott abandoned the field in Central India and H.B. Medlicott was sent to the Himalayas instead of his scheduled survey in the Bundelkhand area. However, the latter was able to determine the separation of the Cambrian Vindhyan region from the Gondwana. During field work geologists sketched beautiful imprints of plants and animals on their notebooks in addition to maps and interesting geological features [fig.25-26].

Fig.25. Tertiary fossils of Himalaya

Fig.26. Gondwana plant fossils

Fossil sketches from A Manual ofGeology of India, H.B.Medlicott and W.T.Blanford, 1893

Geologists had to involve local people to gather information on occurrences of coal and minerals along with wild animals. W.H. Hughes was said to have introduced reward system in a unique fashion, *One rupee for khabar of a coal seam and two rupees for khabar of a bear.* Hunting was a pastime of the geologists, but angling was a favourite hobby. Emulating Mughal Emperors, geologists used to bury ice in deep trenches in deserted areas to quench thirst during scorch summer [fig.27. Camel carts in GSI's field].

Stoliczka made a tremendous effort in collection and record of fossils of the upper reaches of the Himalayas and Burma for nearly 10 years traversing many hard terrains of Sutlej, Spiti, Shimla, Srinagar and more areas before he got exhausted and expired at Leh on 19th June 1874 at the age of 36. The photograph of Stoliczka's memorial at Leh carries the humble gratitude of his great contribution in Himalayan geology [fig.28].

Fig.27. Camel carts in GSI's field

Fig.28. Memorial of Stoliczka at Leh

Fig.29. Iron-ore smelter at Palamow, sketched by T.F. Peppe (Ref. "Jungle life in India" by V. Ball)

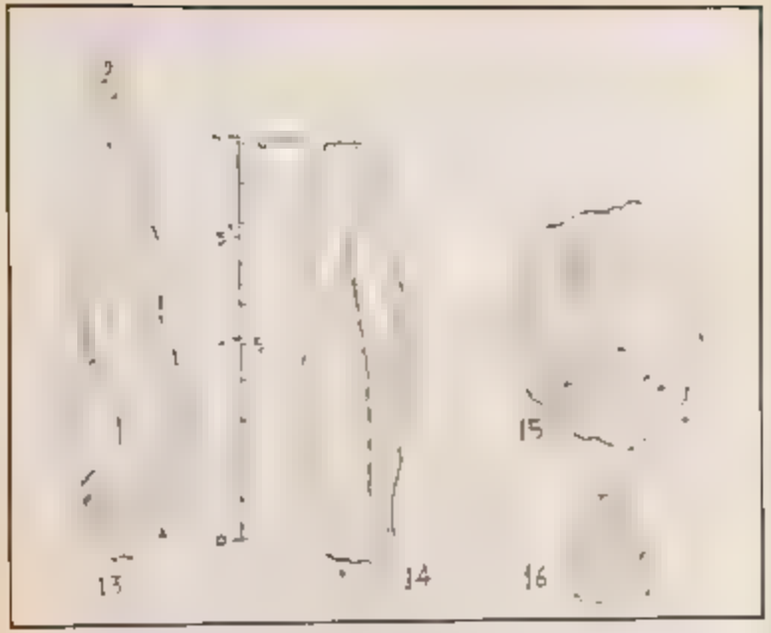
Valentine Ball has given an idea of his field experience in his book "Jungle life in India" and concluded, Experience has shewn how manifolds are the risks to be encountered, while the terms of service at present required, before a full pension can be earned, affords but a faintly-seen vision in the far distant future of a home at home for one who has adopted the carrier as a geologist under the Government of India.

[fig.29. Iron-ore smelter at Palamow; sketched by T.F.Peppe;

fig.30. Ancient stone implements collected from Bengal and Orissa sketched by Ball;

fig.31. Group of Nicobories, Nankowri Island sketched by Ball]

Geologists had to ring the bell of the governments again and again since the time of Oldham to recognise and compensate their hardship in terms of money and service condition. The British Government at times did honour the demand but the Independent India government withdrew the Special Daily Allowance from the Second Pay Commission.



Palaeolithic implements

Fig.30. Ancient stone Implements collected from Bengal and Orissa sketched by V. Ball (ref. Jungle life in India by V. Ball)

Fig.31. Group of Nicobories, Nankowri Island sketched by V. Ball (ref. Jungle life in India by V. Ball)

Fig.32. Group photo: standing-F.Stoliczka, R.B.Foote, W.Theobald, F.R.Mallet, V.Ball, W.Waargen, W.L.Wilson
sitting-A.Tween, W.King, T.Oldham, H.B.Medlicott, C.A.Hacket

The Early Youth : Geographical Expansion of GSI Activity

The work of GSI extended beyond the frontier of the British India. Burma was gradually brought within GSI's sphere of activity. Oldham's visit to Burma's oilfield gave a new orientation in the relation between geological structure and oil accumulation in the area. GSI took overseas expeditions to Abyssinia, Persia and Aden during 1867-1872. Maximum extension of Indian Empire was seen between 1899 and 1937. Thus GSI expanded its working region from Afghanistan in the west to Burma in the east covering 5.7 million square kilometre area. Griesbach worked in Afghanistan, Persia and Turkestan, Hayden at Lhasa, Pilgrim in Persia and Arabia, Pascoe in the Persian Gulf, the Arabian Coast and West Persia, Coggin Brown at Yunan in Eastern China and West in search of coal in northern Afghanistan. However, the working area came down to 3.29 million square kilometre area in 1947. Some exquisite photographs of geological and local interests of these areas may still create envy to others [fig.33-40].

Some of the princely states within India had their respective offices like Mysore Geological Survey and Kashmir Geological Survey organised by officers of GSI like R. Bruce Foote and C.S. Middlemiss respectively.

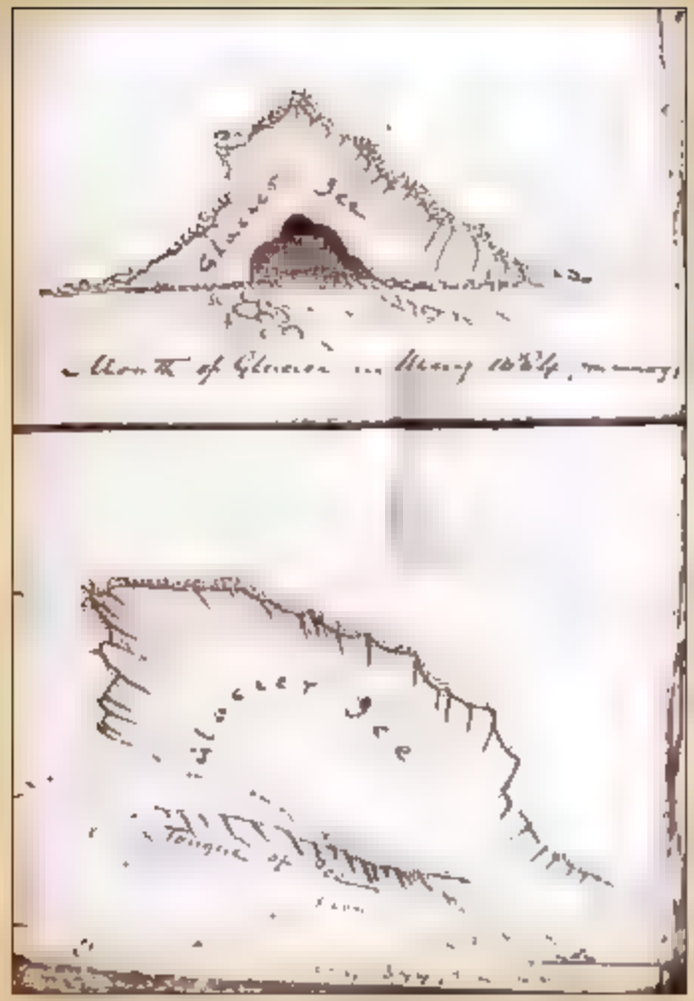


Fig.33. Comparative sketches of Pindari glacier in 1884 and 1894

Fig. 34. Pindari Glacier photo by Walker and A. M. Heron, 1909

Fig.35. Cultivation in Afghanistan, 1884

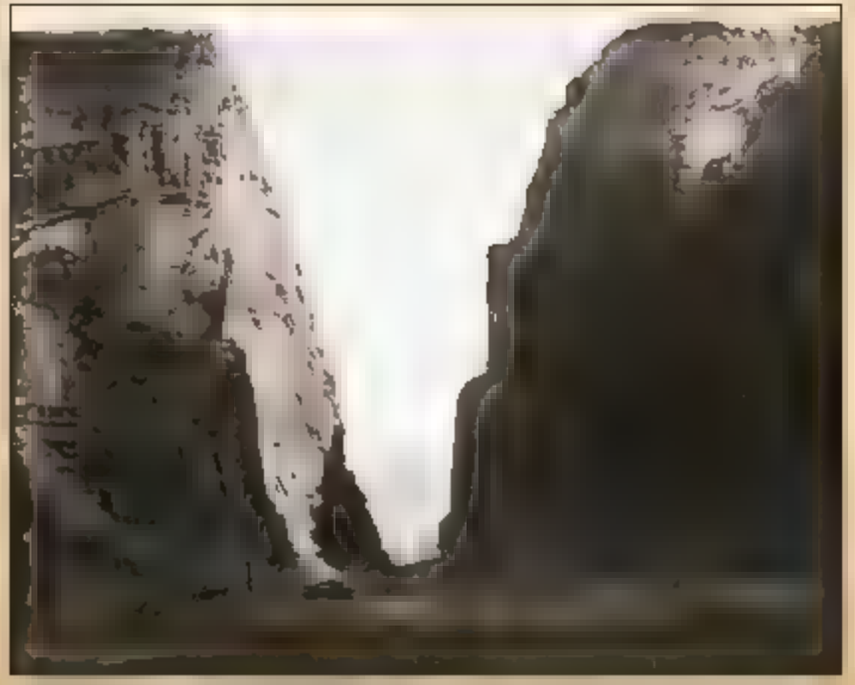


Fig.35. Hindukush, Afghanistan, 1886

Fig.37. Group of people, Afgan-Turkistan, 1886

Fig.38. Lead smelting at Foryal, Afghanistan.
Photo by H H Hayden, 1907-08

Fig. 39. Old alluvium in Salt Range.
Photo by . La Touche, 1909

Fig.40. Chinese coolies transporting a huge boulder of stone; 1929

The Youth : Expansion of Activity and Knowledge ...with Responsibility Bestowed

Activity of GSI started in 1851 with the continuity from previous century in demand of coal that transformed to systematic surveying and mapping for the purpose of gathering more knowledge on the different coalfields and the total geology, and record them in the form of publications of its reports and achievements within the cover of Memoirs, Records and Palaeontologia Indica by the one of the most able chiefs of GSI in its history Sir Thomas Oldham. He initiated publications of geological maps of isolated areas as also of the entire India in various scale. He expanded his area of geological study in the entire India, both peninsular and extra-peninsular. [fig.41. Sketch of an earlier field map of Garumahisani Hill]

He set up the chemical laboratory in 1857 with G. Evans as the first analytical chemist.

He was also entrusted with the charge of the Museum of Economic Geology in 1856, set up with Asiatic Society in 1841, and the collection later shifted to Hastings Street office. Later he became Director of the Museum of Geology.

The importance of GSI was translated into the demand of iron ore for construction of rails for the railways (in operation since 1853) to transport coal from Raniganj Coalfield area. Iron started production in Kumaon from 1857 using local iron ores.

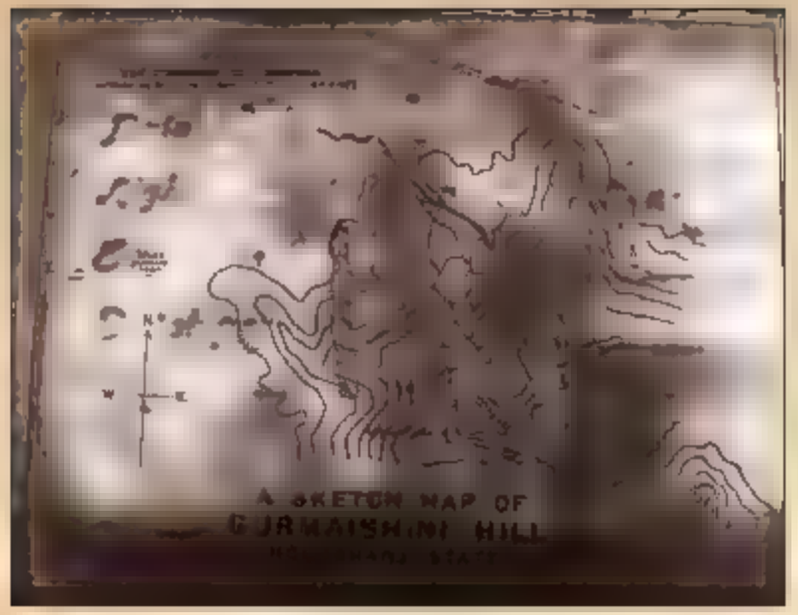


Fig. 41. Sketch of an earlier field map of Garumahisani Hill

Fig.42. Rail line in a colliery in Salt Range.
Photo by La Touche, 1909

Engineering Geology...

Study was initiated by Oldham in 1859 for the proposed extension of railway line in Raniganj Coalfield. He set the ball rolling in such a design that later the British Government made it mandatory to have a prior consultation and clearance for any sort of civil engineering project from GSI, be it communication tunnel, high altitude roads, dam and reservoir, water supply tunnel or anything else. It had been associated with almost all power generation and irrigation projects and provided geotechnical input for various geological problems in preliminary to post-construction stages of the projects. Griesbach, because of desertic arid climate and paucity of water, visited Central Province, Gujarat and Rajputana with the intention of enhancement the supply of water by means of artesian boring.

[fig.43-46 – involvement of GSI in different engineering projects].

Fig. 43. East India Railway pumping station at Barakar Mines, Raniganunge coalfield, 1926.

Fig.44. High level tunnels in Margherita, Assam, May 1927

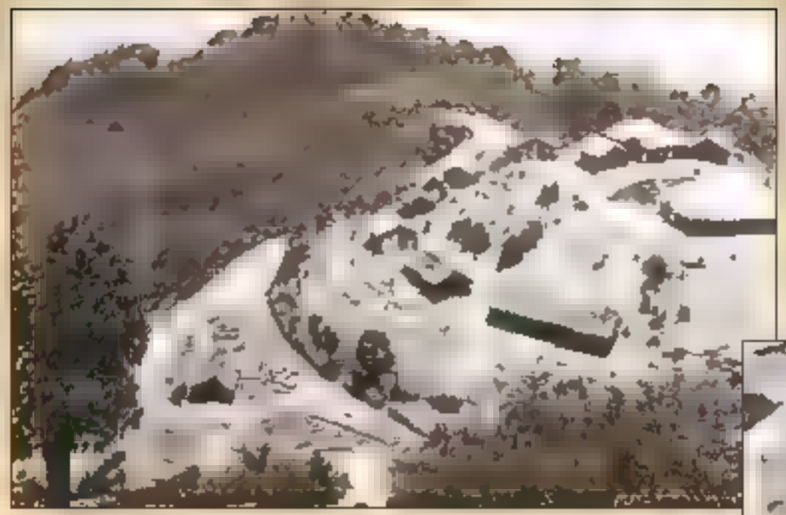


Fig. 45. B.N. Railway Tunnel being made in Paranda, Singhbhum. Photo by C.S. Fox 1926-27

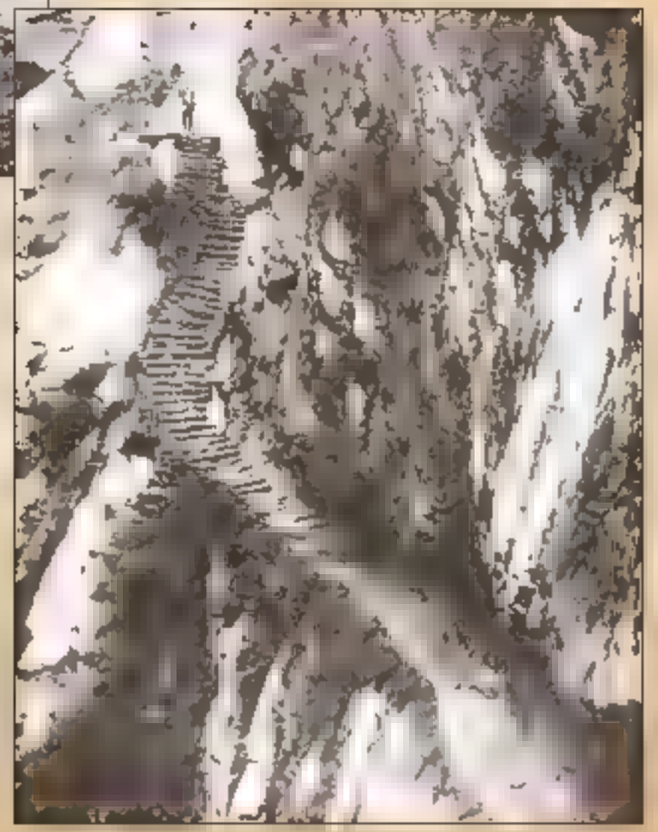


Fig. 46. Road between Pandu Keshwar and Joshimath. Photo by Carl Griesbach,1882

Water, being the most precious thing for survival, though available aplenty in many parts of the country adjacent to river basins but dry too in other parts, was another major area Oldham took up and started **Groundwater** investigation mainly for the purpose of safe drinking water.

Thomas Oldham prepared a list of 201 **Thermal Spring** and later published as Catalogue. He remarked that these thermal springs had their connection with earthquake phenomena and volcanic and quasi-volcanic phenomena.

[fig.47-48 - other source of water]

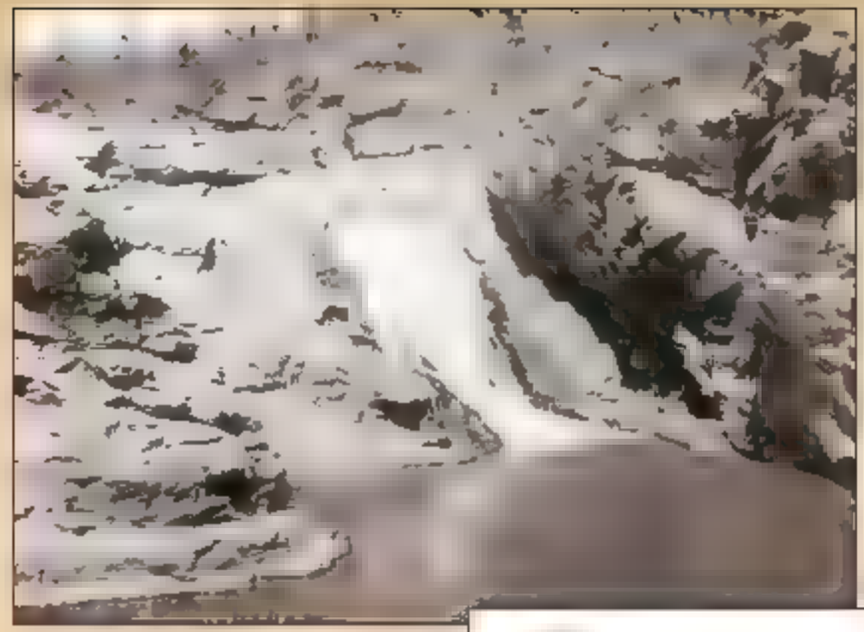


Fig. 47. Dherughag Falls in gneiss - Karo river on Ranchi-Singhbhum boundary, 1924-25

Fig.48. Lake near Mana Garh. Photo by Griesbach 1883

GSI Through Lenses
Antiquity Revisited

The study of **Earthquake** by GSI began with the happenings of the Cachar Earthquake on 10th January 1869 with a magnitude varying from 7.3 to 7.5 that shook the entire northern part of east and north-eastern India. Thomas Oldham took the investigation by himself and submitted a report that came out in the Records of GSI and in the proceedings of the Asiatic Society of Bengal. He also wrote a scholarly and globally appreciated Memoir (Volume XIX Part 1 1882) that published after his demise by his son R.D. Oldham. His masterly detailing account of the earthquake is still a subject of learning for all earth scientists. Till then there was no existing accurate record in the country on earthquakes. He made a Catalogue titled *A Catalogue on Indian Earthquakes from the earliest time to the end of A.D. 1860* published in the said Memoir.

R. D. Oldham, La Touche, P.N.Bose, F.H.Smith, H.H.Hayden, E.V.Vredenburg and G.E.Grimes studied **the Great Shillong Earthquake** of 8.1 magnitude on 12 June 1897 and made a seminal contribution on seismology accounting vividly in GSI Memoir in 1899. In the description it was mentioned that loose stones lying on the surface of the roads were tossed in the air "like peas on a drum". This quake left 1,275,000 sq mile of masonry buildings in ruins with about 1500 casualties. Oldham distinguished three types of pressure produced by earthquakes: now known as P (compressional), S (shear), and L (Love)-waves, based on his observations made after the Earthquake. He showed in 1906 the arrival patterns of waves and suggested that the core of the earth was liquid. [fig.49-50. Impact of Assam Earthquake]

Fig.49. Manshai rail bridge. Photo by R.D. Oldham 1897

Fig. 50. Sand vent, Photo by R.D. Oldham 1897

The Kangra earthquake of 4 April 1905 in the north-west Himalaya was the first of several devastating 20th century earthquakes to occur in northern India. The 7.8 magnitude earthquake killed 20,000 people. Under the order of Director of GSI T.H. Holland, C.S. Middlemiss visited the area and studied in detail the devastations thus caused and published in GSI Records Vol.32 (1905) and Memoir Vol.38 (1910).

[fig.51-58. Imprints of devastations of Kangra earthquake]

Devastations of Kangra earthquake. Photo by C. S. Middlemiss, 1905

Fig. 51. Kulu village

Fig. 52. Landslips Between Sahapur and Chari

Devastations of Kangra earthquake. Photo by C. S. Middlemiss, 1905

Fig. 53. Barjeshwari Devi Temple, Kangra

Fig. 54. Guest House at Kulu

Devastations of Kangra earthquake. Photo by C. S. Middlemiss, 1905

Fig. 55. Twisted Monument at Dharmsala

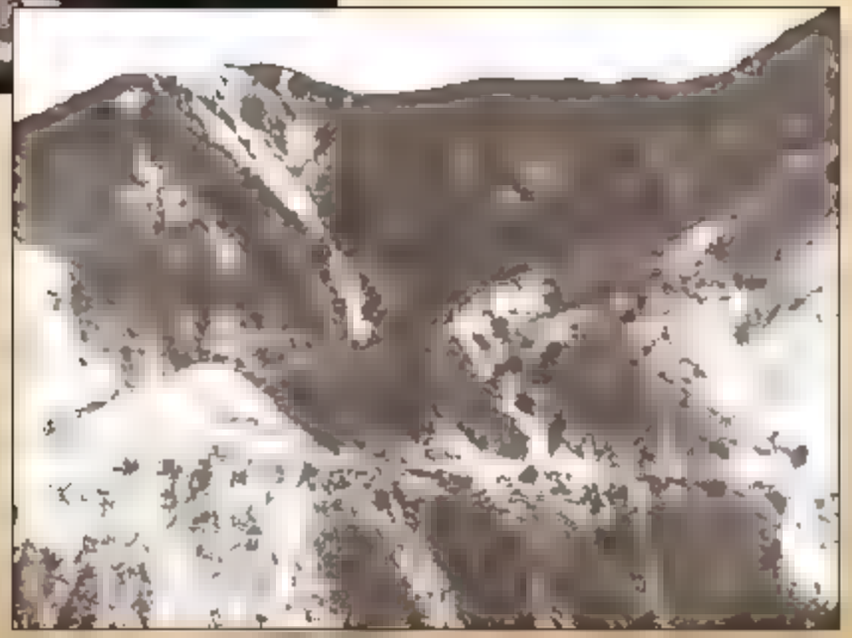


Fig. 56. Landslips at the Great Boundary Fault Drang, Mandi district

Devastations of Kangra earthquake. Photo by C. S. Middlemiss, 1905

Fig. 57. Earl of Elgin's Tomb, Dharamsala

Fig. 58. Bazar at South of Dharamsala Cantonment

Bihar-Nepal earthquake, 1934

A team of geologists comprising J.A. Dunn, J.B. Auden, A.M.N. Ghosh and D.N. Wadia studied the massive earthquake of 8.1 magnitude in Bihar-Nepal area on 15 January 1934 claiming 20,000 human lives. The report of the study came out in the form of GSI Memoir Vol.73 (1939). Following this earthquake, Seismic Zoning Map of India was first compiled in 1935 and recommendations regarding building code was put forward. Later, GSI has been recognised as the nodal agency for macro-seismic surveys in the country due to its vast experience in the field of seismotectonic. [fig.59-67].

Photographs clicked by the geologists of GSI during the study of these earthquakes are the testimony of the great calamities the India withstood.

Dunn was a man of sharp intellect and would not put up with any nonsense or stupidity. He became a trainer in 1944. He donated his entire proceeds of his book on Indian Mining for the cause of Indian soldiers who lost their visions in the Second World War.

Bihar – Nepal Earthquake, 1934 Photo by J. A. Dunn

Fig. 59. Rail line near Sitamari

Fig. 60. Bridge at Samastipur, Darbhanga

Bihar – Nepal Earthquake, 1934 Photo by J. A. Dunn

Fig. 61. Fissure at Sitamari

Fig. 62. Rail bridge near Sitamari

Fig. 63. Bridge over Kali Kosi at Bhamhenagar

Bihar – Nepal Earthquake, 1934 Photo by J. A. Dunn

Fig. 64. District Magistrate Bunglow, Sitamari

Fig. 65. Sand vents, Sitamari, Looking NE

Bihar – Nepal Earthquake, 1934 Photo by J. A. Dunn

Fig. 66. Mongyr Club, Sitamari, Looking NE

Fig. 67. Totally collapsed Bazar, Monghyr, Looking West

The **Himalayan Geology** was another field of attraction of study. During 1876-1887 Meddlicott, Theobold and Lydekkar made a cursory survey of Tertiary deposits of Pir-Panjal area of Jhelum valley. Garwal Himalaya was extensively covered by Carl Griesbach. Blanford carried out detailed mapping in Baluchistan and southern Afganistan. He completed the mapping of Tertiaries of Sind with Fedden. Stoliczka carried out study in Spiti, Middlemiss in Garhwal and Lydekkar in Hundes basin. Bose worked in Jaintia Hills and reported good quality coal seams and fire clay. La Touche and P.N.Dutta worked in the Shan States of Burma and discovered gratolite shales underlying trilobite beds. In the twentieth century H.H. Hayden, a great climber and explorer, initiated the study of Himalayan Glaciers. He along with La Touche and Coggin Brown carried out surveys of snouts of glaciers in the Karakoram, Kumaon and Sikkim. Their in-field photographs on variable interests have enriched the aesthetics of GSI. Following retirement in 1921 as Director, Hayden died in 1923 from a rock fall while climbing on the Finsteraarhorn in Switzerland. Excellent photograohy done by the workers some of which are presented in fig.68-73.

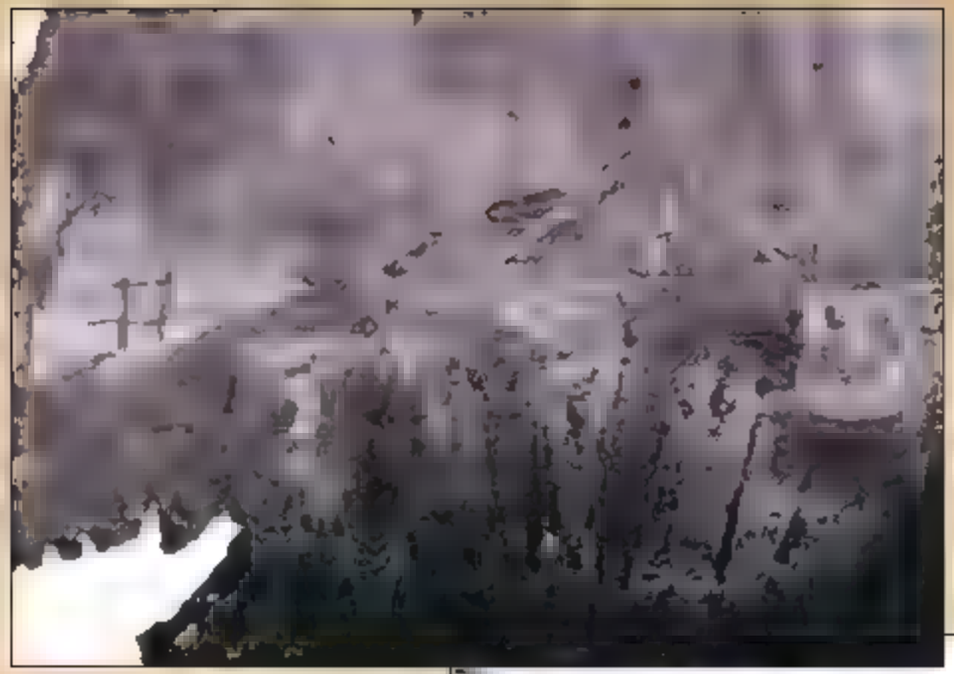


Fig.68. Monolith at Gupkar, Srinagar Photo by R.D.Oldham, 1903

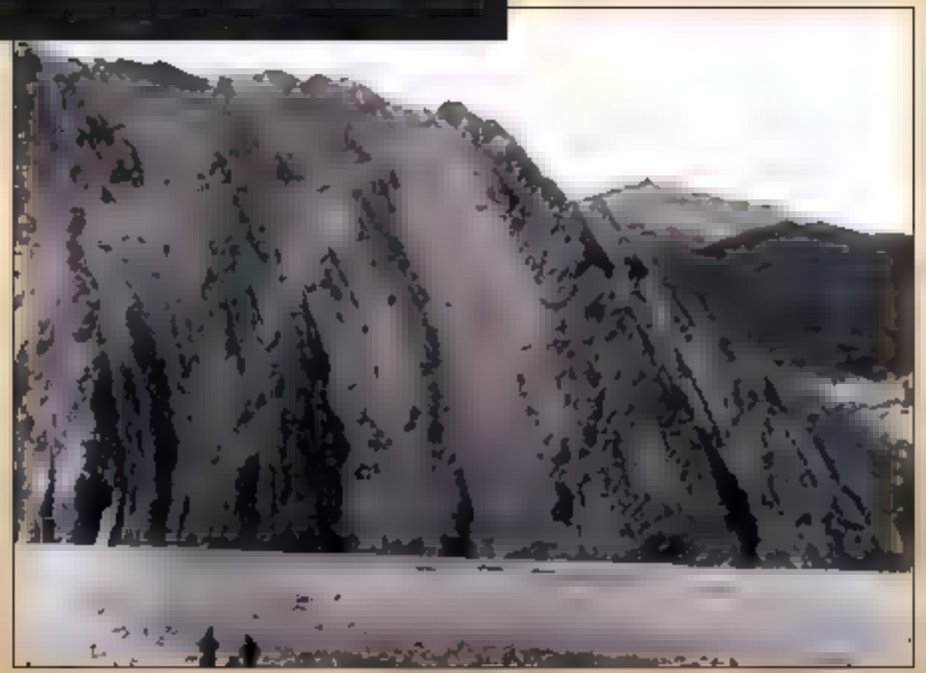


Fig.69. Rhaetir Beds, Shinki River, Hundes, Photo by C. L. Griesbach, 1882

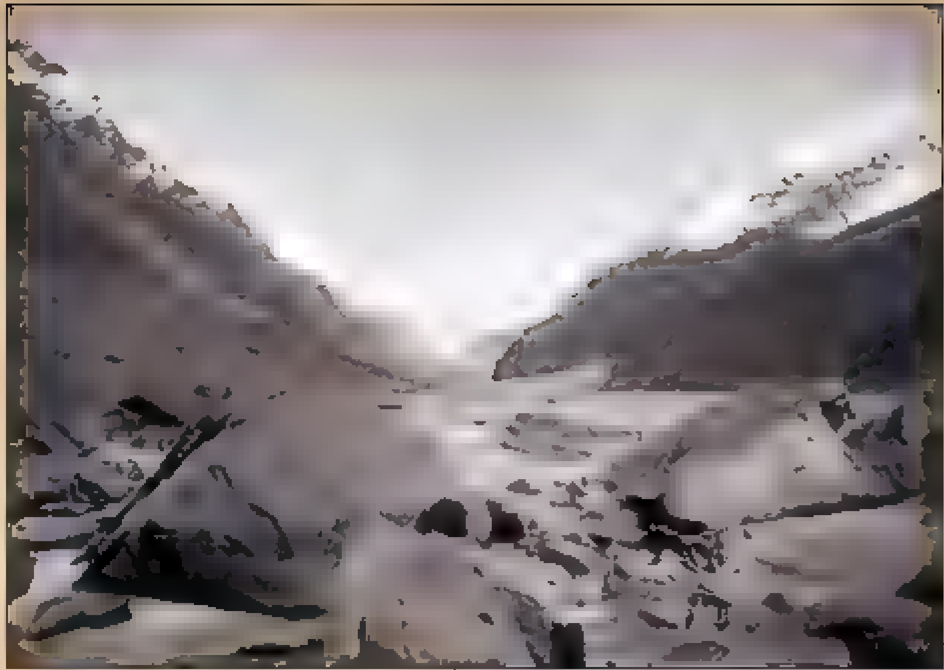


Fig. 70. Sonapani glacier, Lahoul, Kangra Photo by H. Walker, 1906

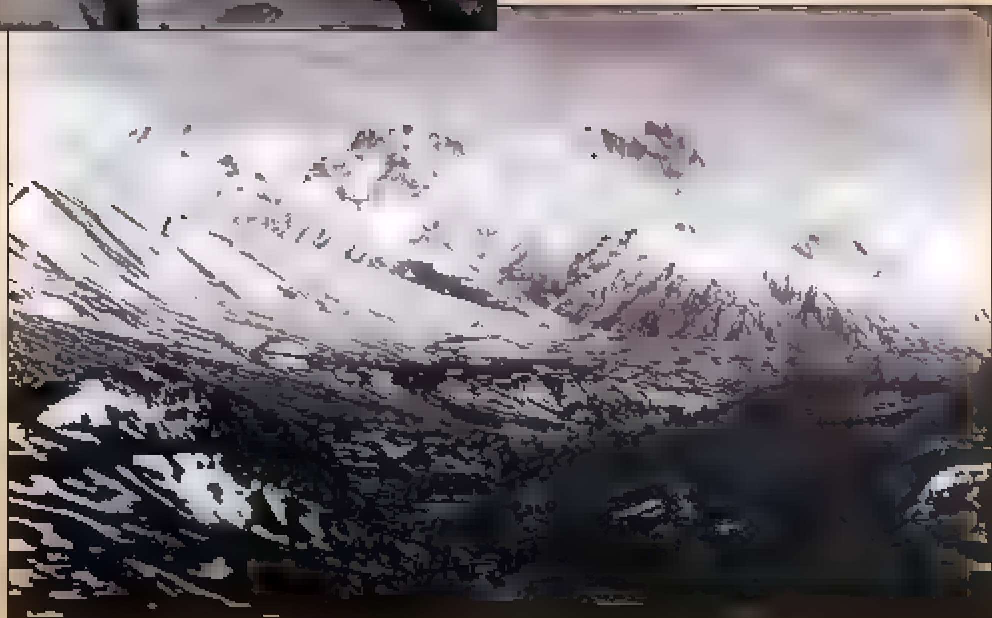


Fig.71. Bhallbol Glacier, Upper Yarkhun Valley, Photo by H.Walker, 1906

Fig.72. End Moraine of Gangotri Glacier from Gau Much, Photo by C. L. Griesbach

Fig.73. Nilang Glacier, Tihri, Garwal, Photo by C. L. Griesbach, 1882

Fig.74. Memento presented to Hayden on his superannuation

While carrying out the geological investigation and survey in the Himalayan region, the geologists could not escape from the aesthetic beauty of the mountains. They, however, recorded not only the nature but the architectural marvels too along with the life style of the local people. All these were captured by them sincerely in their camera. Today, these photographs are invaluable assets of the GSI and some of them are being presented in fig.75-84.

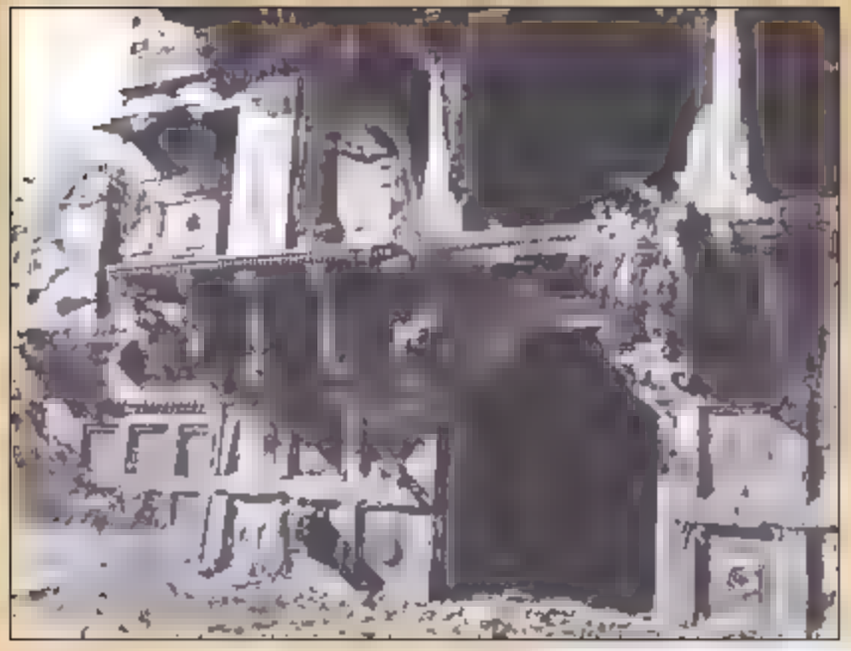


Fig.75. Palace Srinagar, Garhwal.
Photo by C. L. Griesbach,
1882

Fig.76. Palace Srinagar, Garhwal
Photo by C. L. Griesbach,
1882

Fig.77. Temple Gangotri
Photo by C. L. Greisbach,
1883

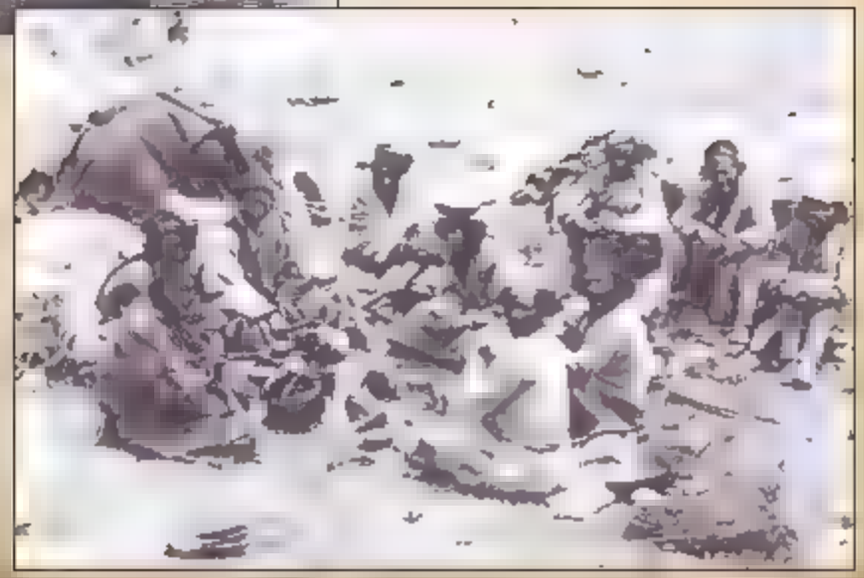


Fig.78. Group of Hunias and Coolies,
Shinki Camp, Hundes.
Photo by C. L. Griesbach, 1882

Fig.79. Temple Ukhimath. Photo by C. L. Greisbach, 1893

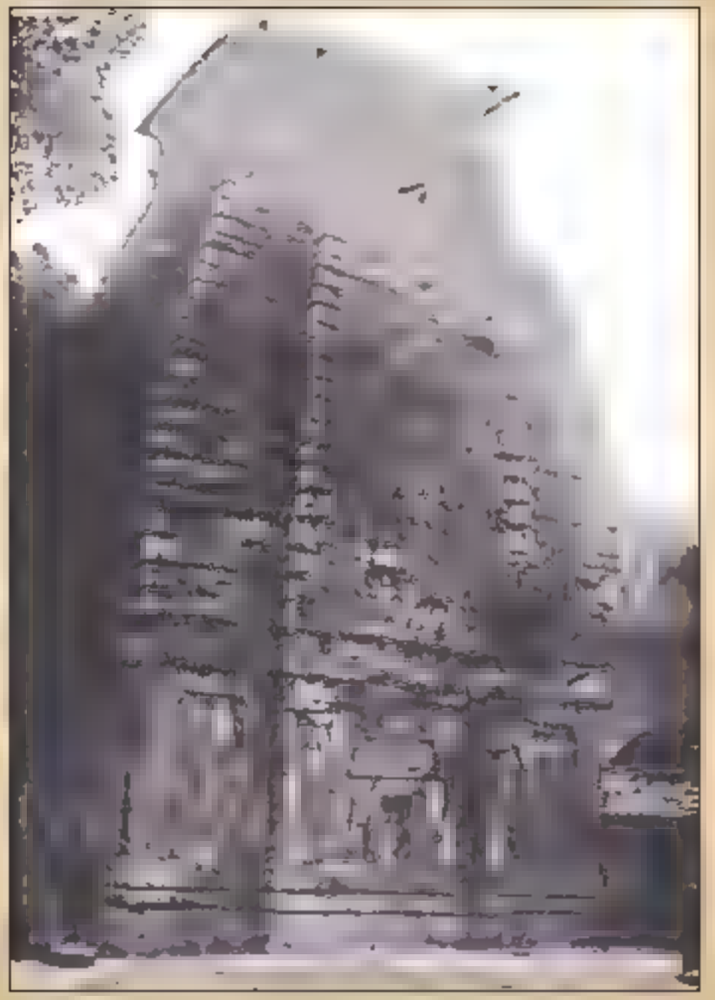


Fig. 80. Temple Gopeshwar. Photo by C.L. Greisbach, 1882

Fig.81. Temple and Brahmins,Gangotri (Himalayas). Photo by C. L. Greisbach, 1883

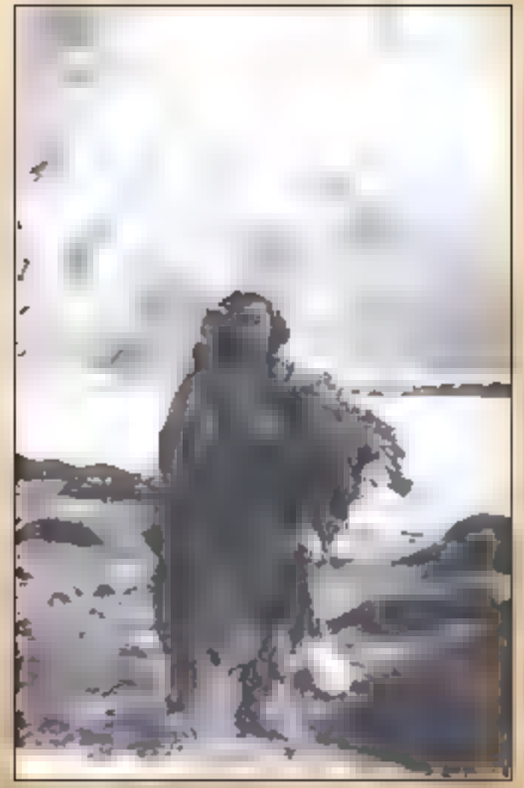


Fig.82. Begging Lama, Shinki Camp, British Garwal. Photo by C. L. Greisbach, 1882

Fig. 83. Dharamasala near the Ukhimath temple Ukhimath, Garwal. Photo by C. L. Greisbach, 1882

Fig.84. Mission House, Puch, Kannawar Himalayas. Photo by C. L. Greisbach, 1883

Long before Alfred Wegener's Continental Drift theory was conceived and accepted, R.D. Oldham in 1884 had written in Proceedings of the Asiatic Society of Bengal, Calcutta, ... reviewing the palaeontological evidences noticed among floras and faunas of India and Africa, the probability of a land connection between India and Africa was bright, and he came to the conclusion, such connection probably took the form of a chain of large islands separated by narrow straits, and long continued and close relationships between the Indian and African floras pointed to the conclusion that the two regions must have been on the same side of the equator and not on opposite side as now.

Initiation of the Great Jigsaw Puzzle on the Earth!

With the superannuation of Sir Thomas Oldham in 1876 after 25 years of uninterrupted service the 'Era of Oldham' culminated and the GSI rolls on its strong pillars founded by him.

On and off the field Thomas often made superb sketches and drawings, sometimes simulating a hill-cut section he drew a figure of his colleague or sometime described the enjoyment of officers after return from field through sketch and many such. Such wits are worth to preserve [fig.85].

Calcutta is proud of its magnificent building of the Indian Museum on Chowringhee Road and owes to this great man for his untiring effort in making this reality. The GSI office [fig.86] was shifted to the newly constructed building adjoining the Indian Museum on 1st January 1875 while the museum was opened to the public on 1st April 1878.

In spite of his chequered career he received a stricture from the Court of Directors in 1856 while confirming his renewal of contract for the second term for not submitting the progress report so regularly as desired. In recent years some officers have been charge sheeted for non-submission of reports in time.

Fig.85. Sketches drawn by Thomas Oldham on and off the field; W. King and Robert Bruce Foote were his favourable models

Fig.86. GSI Building since 1875. Photo by: V.P. Sondhi (presently, 27, Jawaharlal Nehru Road)

In an effort to Indianise the organisation, Oldham appointed Ram Singh as geological apprentice in 1873 and Kishen Singh in the following year. They were promoted to the posts of Sub Assistant in 1879. P.N. Bose was the first Indian to join GSI in officer grade in 1880, followed by P.N. Dutta in 1887.

P.N. Bose first introduced the study of rocks and minerals under microscope and gave accounts of micro-sections in aid of petrology work in progress reports though the astounding petrographic descriptions of the "Central Gneiss" of the Simla Himalayas studied under microscope was the first of its kind introduced by Col. Mc Mohan of Indian Staff Corps in 1877. Bose's microscope is a rare piece of exhibit in GSI [fig.87].

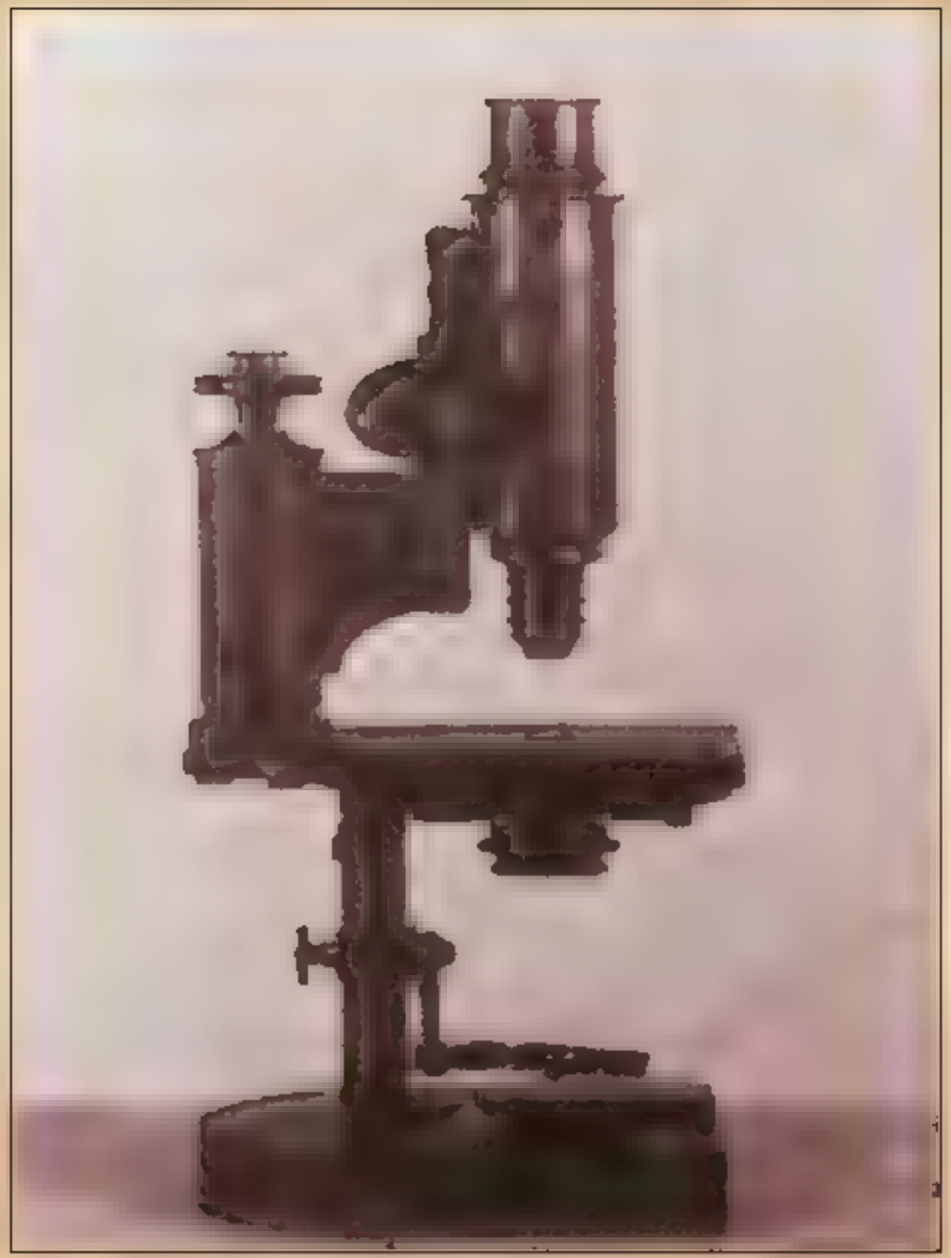


Fig.87. 19th century Microscope used by P. N. Bose

GSI took the responsibility of expansion of knowledge of geology among students and started teaching for the first time in India at Presidency College at Calcutta from 1892 and later at Madras. T.H. Holland was the part-time professor at Calcutta.

E.H. Pascoe took a leading part in planning and founding of the Indian School of Mines (rechristened later Indian School of Mines and Applied Geology) at Dhanbad and it was opened in 1927. Pascoe was the president of the governing body of the school.

New Additions To The World of Geology

H. B. Medlicott, one of the finest geologists in the primitive years of GSI, succeeded rightly after superannuation of Sir Thomas Oldham. Geological Map of India on 1 inch = 64 mile scale whose compilation work was initiated by Oldham was published under Medlicott in 1877. The Manual of Geology of India which Oldham hoped to undertake got published in 1879. These two monumental work were the main outcome of first 25 years of work of GSI that laid strong foundation on the knowledge of geology of India in the world of geology.

Study of coal on geological perspective and in a systematic way was initiated by Oldham and a number of maps and reports of most coalfields were published since then. W. T. Blanford, B. F. Blanford and Theobold in 1857 identified the basal beds of coal bearing series in Talcher Coalfield as plausible glacial origin. [fig.88. Damuda Ranigaunge Coalfield Map]. Comparing the vertebrate fossils and Glossopteris and other plant fossils discovered from the Panchet rocks with those of vertebrates from Europe, South Africa and plant fossils of Australia, Thomas Oldham assigned the age of Triassic, Permian and Upper Carboniferous to the rocks of Lower Gondwana. H.B. Medlicott explored the Cretaceous coalfields of the Garo and Khasi Hills. Studying all the coalfields, Medlicott proposed the concept of Gondwana System in 1872 in a manuscript report for coal bearing formations of age older than Cretaceous. The term 'Gondwana', first coined by Medlicott from the name of the tribe 'Gond', was adopted officially in GSI publication (Records IX, Pt.2, pp.28) by Ottokar Fiestmantel in 1876. [fig.89. Fossil tree at Asansole]

Fig.88. Damuda Raniganj Coalfield Map (1857) (from Geology of India by N.P.Chowdhury)

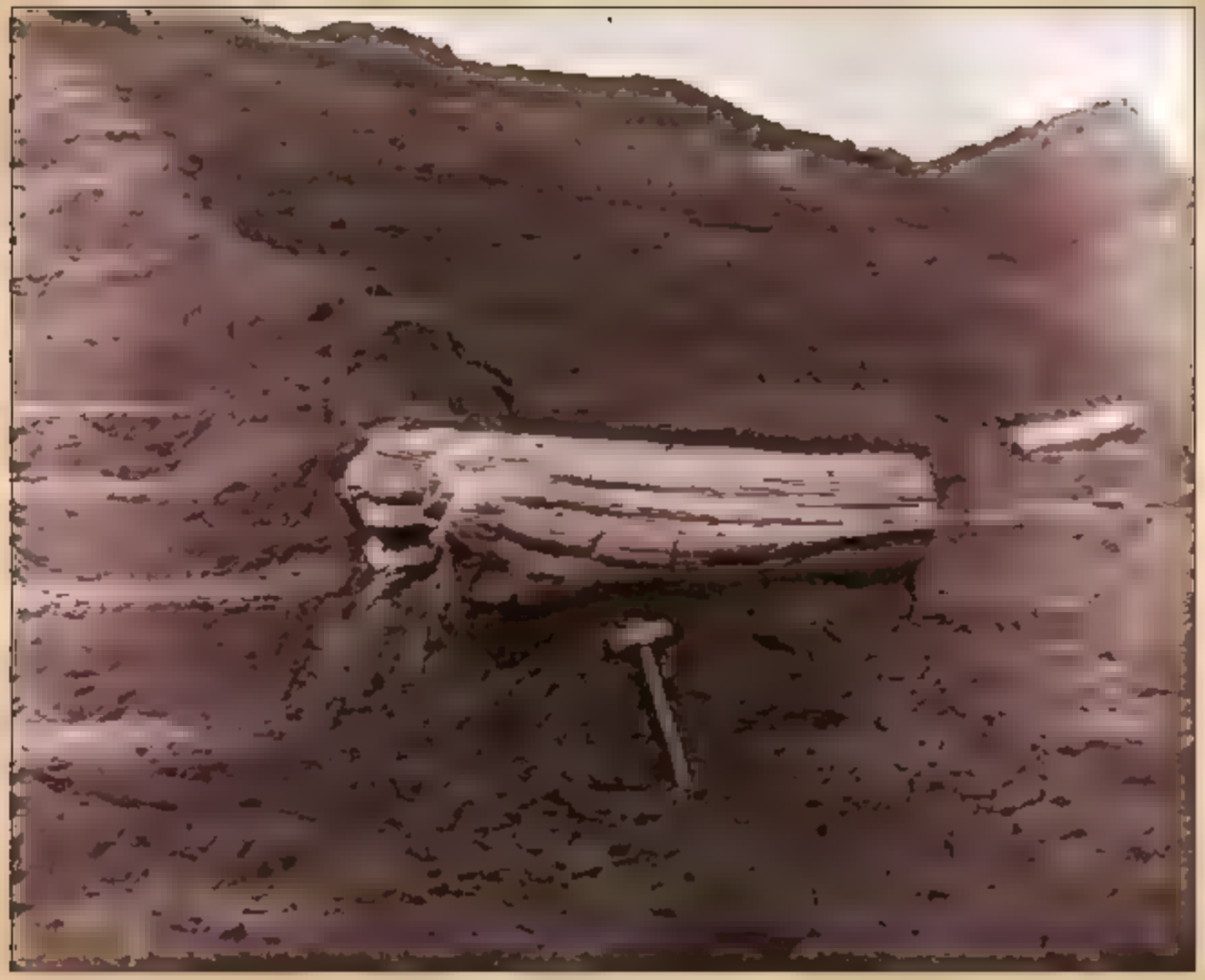


Fig.89. Fossil tree at Asansole

GSI Through Lenses
Antiquity Revisited

P. N. Bose introduced a new nomenclature 'Chilpi Ghat Series' for the metamorphic rocks of Lower Narmada Valley during mapping the Vindhyan rocks in 1884. This was later designated as 'carbonatite'.

H. Walker introduced a new term 'khondalite' in Indian petrology for a garnet-sillimanite-quartz-graphite schist rock in the Eastern Ghats.

T.H. Holland discovered a new hypersthene bearing rock in south India and named it 'charnockite' after the name of Job Charnock, the founder of Calcutta. The tombstone of Job Charnock in Calcutta was the first sample of this rock for study. Holland authored the classic Memoir on charnockite in 1900.

By the end of the nineteenth century, the world was exposed to the geology and stratigraphy of India including the Himalayas. The discoveries of new genera and species of fossils including mammalians and Primates of almost the entire geological timescale from the Himalayan region and the peninsular part were of great help in palaeontology and building up the international stratigraphy. Many are regarded as prototype. Long succession of the Himalayan Survey led to the well known publication 'Sketch of the Geography and Geology of the Himalayan Mountains' by Hayden of GSI and Burrard of Survey of India in 1907. The concept of tectonic disposition of the outer ranges rested with that of the Main Boundary Faults had been developed by Middlemiss.

In Peninsular part of India, extensive ground survey and mapping had been carried out to establish the geology and stratigraphy of Central Provinces, Eastern Ghats and Rajputana (Rajasthan). In the first decade of the last century, E. V. Vredenburg threw a new light on the classification of the Vindhyan rocks in Central India. He also wrote a valuable account of the diamond-bearing conglomerates of the Panna State. Mapping of the Archaeans and younger rocks of Central Provinces was undertaken by P.N.Dutta and L.L.Fermor leading to the discovery of a large number of important deposits of manganese-ore. C.S.Middlemiss mapped Vizagapatnam Hill Tracts where he encountered a number of interesting rock types in association with charnockite and khondalite. Some of the interesting photographs are presented in fig.90-102.

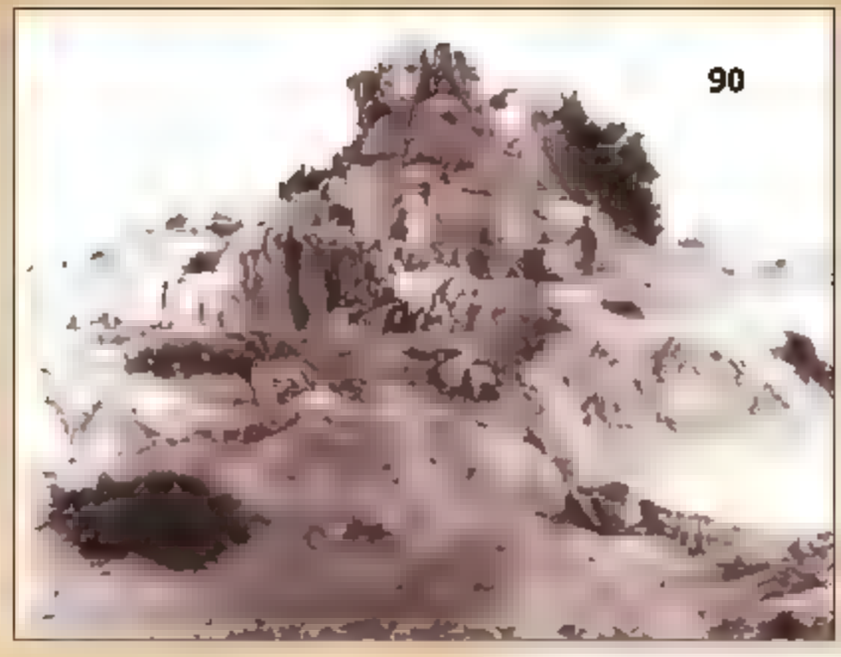


Fig.90. Pas Sandstone on Gneiss, Madhya Pradesh.
Photo by: P. N. Dutta and L. L. Fermor, 1909

Fig.91. Pas Sandstone on Gneiss, Madhya Pradesh.
Photo by: P. N. Dutta and L. L. Fermor, 1909

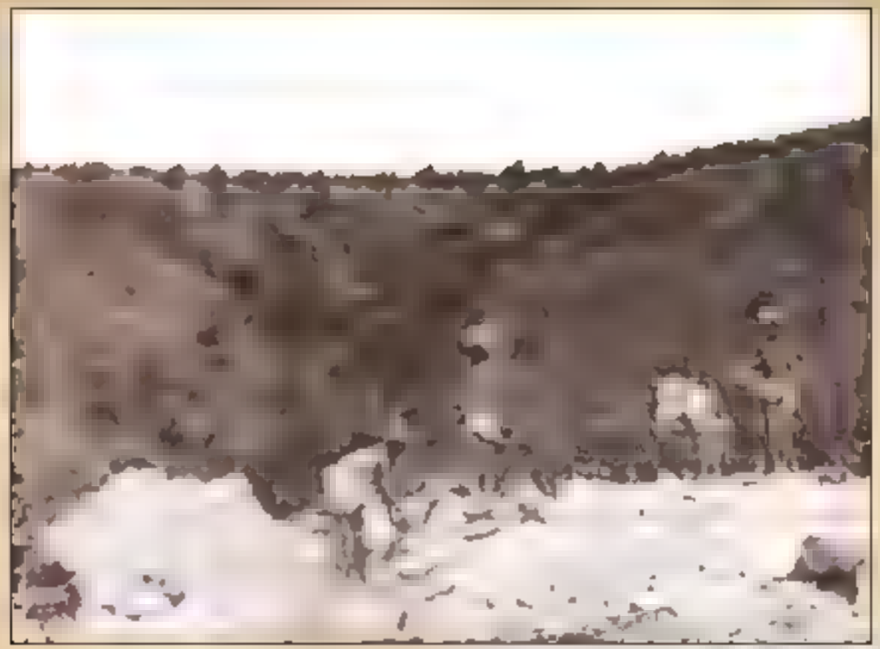


Fig.92.Clay Mine near
Raipur, Gwalior.
Photo by : E. Vredenburg, 1908

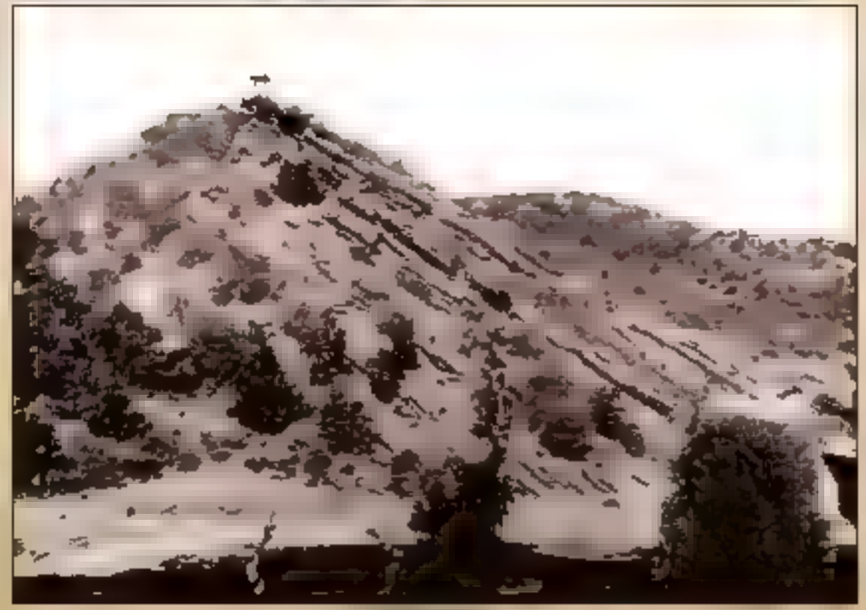


Fig.93. West side of Railway Darai
Kotal Station.
Photo by : Vredenburg, 1908

Fig.94. Kymore Scarp,
Fort Gwalior, Gwalior,
Photo by : E. Vredenburg, 1908

Fig.95 Kymore sandstone and
fort, Pichor.
Photo by . E. Vredenburg,
21 Feb, 1909

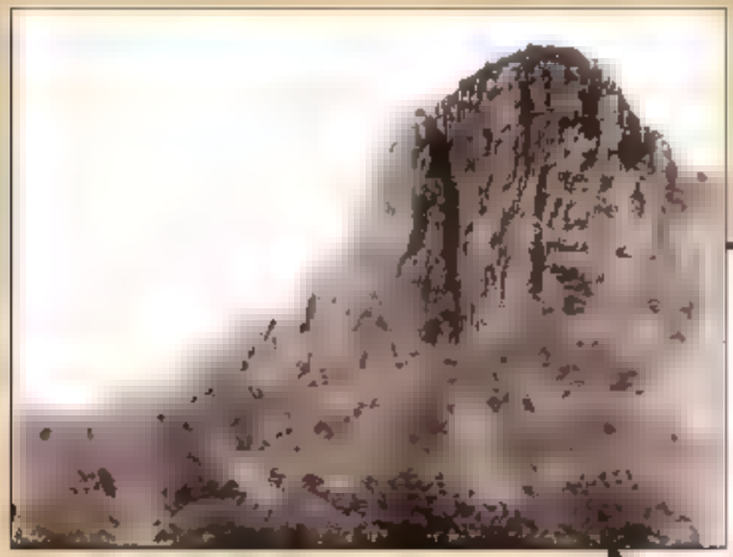


Fig.96. Quartzite ridge in gorge south of Undhania. Chota Udepur state, Gujarat. Photo by : G.B.Hobson, 23 April, 1926

Fig.97. Columnar structure in basalt Near Dongr , Siloette, 1920-21

Fig.98. Current bedded sandstone Barakar. Kudia nala near Chanch, Ranigaunge coalfield, April 1926

Fig.99. Fold in Cretaceous rocks above Khojagon north of Saislan Valley. Phto by: H. H. Hayden

Fig.100. Folded Sandstone due to intrusion of mica peridotite. 4 miles south of Asansol. Photo by : C. S. Fox 1925-26

Fig.101.Banded calcitic marble. Lohangi stage, Sauser series. Nagpur District, (11 March, 1925)

The systematic mapping of Rajputana was carried out mainly by A.M.Heron and continued till next two decades with intermittent break for surveys in other areas, especially to Burma during the First World War. He published excellent Memoirs on Rajputana with exquisite photographs. [fig.103-105]

G de P Cotter made important contribution to the geotectonics of the Tertiary Irrawady basin that laid the foundation for subsequent stratigraphical work on the Tertiary basin of Burma.

The Lower Chindwin volcano is a field of 7 or 8 explosion craters along the lower Chindwin River in central Myanmar. Most cones and lava flows are older than 10,000 years. R.D. Oldham studied the craters some of which are filled with water to become lakes. [fig.106,107]

As the geology of the country started unfolding slowly, the stratigraphy, structure, petrography of different rocks, mineral and coal deposits were established that fed the world of geology to understand the evolution of the planet through time.

Fig.102. Jasper Ironstone shale, Ratowar, 1909, Vredenburg.
Photo by : F Vredenburg

Fig.103.Scarp of Ajabgarh, Makreta,Laksmangarh Tehsil, Alwar.
Photo by : A. M. Heron, 1925

Fig.104.Triple Anticline, Makreta, Laksmangarh Tehsil, Alwar.
Photo by : A. M. Heron, 1925

Fig.105.Ajabgarh beds dipping at 65 degrees. Hodaheli, Ragjarh Tehsil, Alwar.
Photo by : A. M. Heron, 1925

Fig. 106 Twin Crater Lake at Chindwin.
Photo by : R. D. Oldham, 1903

Fig. 106 Twin Crater Lake at Chindwin.
Photo by : R. D. Oldham, 1903

Science and Economy

In 1890, GSI's work was divided into scientific and economic sections, with two third of the staff given to the scientific studies.

Since early twentieth century, GSI gave importance in development of mineral resources in India as a step towards industrialisation in the mineral sector without neglecting the academic side of geological mapping.

In 1901 Indian Mines Act was passed. In 1902 mining side was isolated from GSI and the Department of Mines formed in 1904 in Calcutta, later shifted to Dhanbad.

Along with comprehensive surveys on coalfields of India, surveys on manganese-ore deposits in Central Provinces, copper-ore deposits in Singhbhum, iron-ore deposits of Central Provinces and Bastar, bauxite deposits in various parts of India and oilfields of India and Burma were also taken care of. This made India the major producer of manganese by 1907 and later copper added to the list of mining industry. [fig.107-121]

Fig. 107, Gas pool. One mile NNW of Chaingzauli village, Upper Burma. Photo by: G de P Cotter, 1909

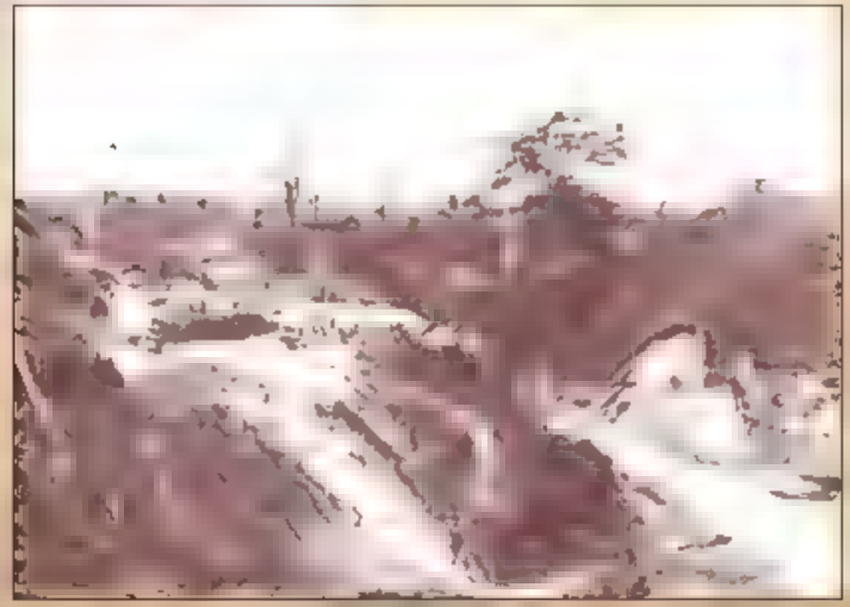


Fig. 108. Oil field, Digboi, Assam.
Photo by : C. S. Fox, 1927

Fig. 109. Rasambazar Chinaclay works, Ratepara, Singhbhum district, 1926-27

Fig. 110. Coalfield, Makum, Likhapani.
Photo by : C. S. Fox, May 1927

P. N. Bose, accredited with the discovery of iron-ore deposits of Central Provinces and Bastar in 1903. Following retirement soon after from the Department, he discovered large deposits of iron-ore in Mayurbhanj in 1904 leading to the foundation of the great enterprise of the Tata Iron and Steel Company. This heralded the industrial revolution in India.

The First World War was responsible for shifting the attention of the Department to the development of the wolfram, mica and other strategic minerals. Coggin Brown and Heron were put in charge of study of tin-tungsten mineralisation and ore deposits in Tavoy district of Burma and C.S. Fox was placed in charge of the Mica Mines at Jorasemar in Bihar.

Geological survey and investigation resumed after the War I in the Peninsular India from early 20s' of the last century. Detailed mapping started in the Archaean terrains of Central Provinces by Crookshank and W.D.West under the leadership of Fermor and in Rajputana by Coulson, Iyer, Gupta, Ghosh etc under Heron. H.C. Jones continued his surveys in Bihar and Orissa in iron-ore belt of Singhbhum district, Bonai and Keonjhar.

Fig. 111. Damagaria Quarry, 4 miles north of Barakar railway station.
Photo by : C. S. Fox, 1925-26

Fig. 112. Dhemomani colliery, between Asansol and Sitarampur Raniganunge coalfields.
Photo by : C. S. Fox, December 1925

Fig. 113. Shankarpur colliery, Ranigaunge coalfield.
Photo by : C. S. Fox, April 1926

Fig. 114. Coal Quarry, Near Ledo, Margareta, Upper Assam.
Photo by : C. S. Fox, May 1927

During 20s, the geological re-survey of all the coalfields of India on modern maps was necessitated for commercial development of coal in order to help the mining industry. C.S.Fox led a team to make a general survey of all the coalfields including those in Assam while detailed survey of Jharia and Raniganj coalfields was carried out under the leadership of E.H. Pascoe.

Indian Iron and Steel Company was established at Burnpur in 1926 [fig.116].

Much attention was given to mapping and exploration in Burma during E.H. Pascoe's tenure as Director(1921-1932). A lot of geologists worked in the area. In 1929 Brown and Banerjee began large scale geological mapping of the Mogok Stone Tract and divided the Archaean rocks into a number of stages. Understanding the importance of the oil fields of Burma, Pascoe introduced the system of placing an officer of the department as Resident Geologist for reporting day to day progress of investigation and development.

Lignite deposits of Neyvelli was discovered in 1934 with an estimation of 2000 million tons of reserve covering 100 sq mile area. Around same time lignite deposits located in Kutch area.

Fig. 115. Bengal Iron Works at Kulti.
Photo by: C. S. Fox, 1925-26

Fig. 116. Indian Iron & Steel Co., Hirapur near Asansol.
Photo by : C. S. Fox, December, 1925-26

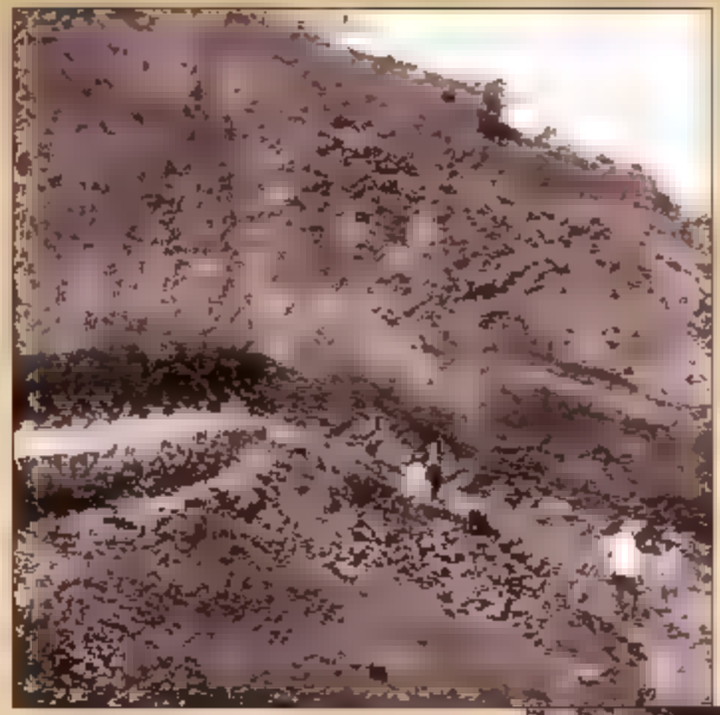


Fig. 117. Tirap Query, Near Ledo, Margareta, Upper Assam.
Photo by : C. S. Fox, May, 1927

Fig. 118. Manganese working at east end of Pani mine. Chota Udepur State, Gujarat. Photo by : G. B. Hobson, 1926

Fig. 119 Prospecting for mica near Lalka Jorusemar.
Photo by : C. S. Fox, 1918-19

Fig. 120. Mica godown, Jorasemar.
Photo by : G. S. Fox, 1918-19

Fig. 121. Pay day, Jorasemar Mica Factory
Photo by : C. S. Fox, 1918-19

In the late 20s and early 30s of the last century, Burma had witnessed a series of earthquakes causing moderate to severe damage in many areas. R.D. Oldham and J. Cogging Brown of GSI studied in great details. Coggin Brown studied the Pyu earthquakes of 3rd and 4th December 1930 and subsequent Burma earthquakes upto January 1932.Extensive accounts of these earthquakes were described by them in Memoirs.

A good number of photographs on the subject snapped by Cogging Brown are worth preserved in the archived section of GSI [fig.122-123]

Fig. 122. A fissure with a vein.
Photo by : Coggin Brown, 07.02.1931

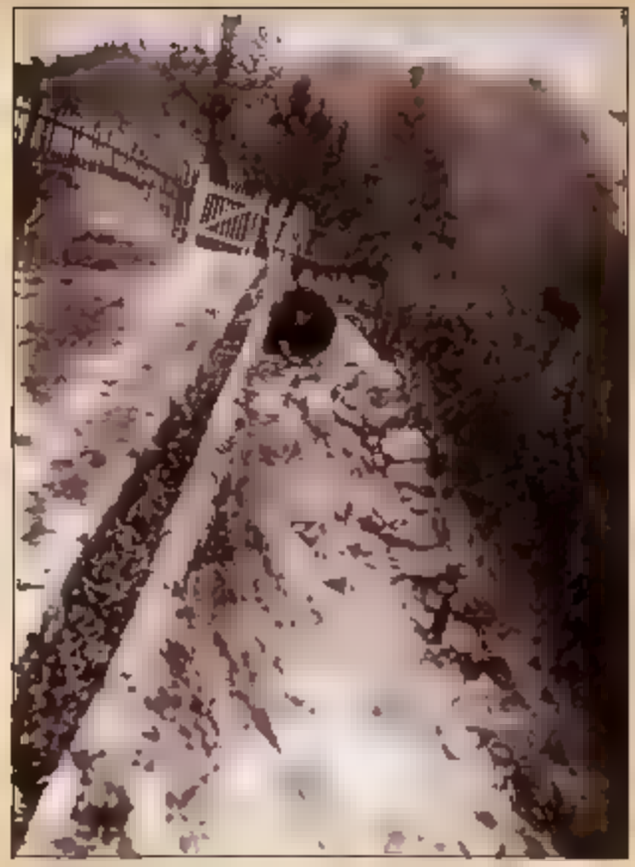


Fig. 123. Retaining walls near A S Ithawgaws quarters destroyed by earth quake shocks.
Photo by : Coggin Brown, 17.12.29

Mount Everest Expedition....in 1921

The first British expedition – organized and financed by the newly formed Mount Everest Committee – came under the leadership of Colonel Charles Howard-Bury, with Harold Raeburn as mountaineering leader, and included George Mallory, Guy Bullock, A.M. Heron and Edward Oliver Wheeler. It was primarily for mapping and reconnaissance to discover whether a route to the summit could be found from the north side. As the health of Raeburn broke down, Mallory assumed responsibility for most of the exploration to the north and east of the mountain. He wrote to his wife: "We are about to walk off the map..." After five months of arduous climbing around the base of the mountain, Wheeler explored the hidden East Rongbuk Glacier and its route to the base of the North Col. On September 23, Mallory became the first person to set foot on the mountain and he, Bullock and Wheeler reached the North Col at 7,020 metres (23,030 ft) before being forced back due to strong winds. To Mallory's experienced eye, the route up the North ridge intersecting the NE Ridge and from there to the summit looked long, but feasible for a fresher party. Heron worked out the geology of the area around Mount Everest. [fig.124]

.....In 1965

C. P. Vora of GSI climbed the Mount Everest as a member of an expedition team.

Fig. 124. 1st Everest expedition Group (1921) Sitting Mallory, Wheeler, Bullock, Morshead Standing- Wallaston, Howard-Bury, A. Heron, Raeburn. Photo by : A F R Wallaston

The river Indus, romanised form of the ancient Greek word "Indós", borrowed from the old Persian word "Hinduš", which in turn was derived from the Sanskrit word "Sindhu", is a major river in Asia which flows through Pakistan. It also has courses through western Tibet and Northern India. Originating in the Tibetan Plateau in the vicinity of Lake Mansarovar, the river runs a course through the Ladakh region of Jammu and Kashmir, towards Gilgit and Baltistan and then flows in a southerly direction along the entire length of Pakistan to merge into the Arabian Sea near the port city of Karachi in Sindh. The total length of the river is 3,180 km (1,980 miles). GSI has carried out extensive work during the course of its survey and many of its reports carry the geomorphology and geology of the area the river passes through [fig.125].

Fig. 125. Indus debouchment

Epilogue

It is rather difficult to build up a story on the history of GSI from the archived photographs taken by the great geologists of yesteryears. It is also difficult to fathom the emotion of those great scientists on which they had clicked their shutters. The subject of the photo varies widely from geology through nature to social life.

It is rather difficult to arrest the temptation of mentioning one photograph of a building of GSI at Calcutta adjacent to the Indian Museum and Government Art College on Chowringhee Road. GSI got this marvel designed building in the 50's of the last century from the government. The building that witnessed all the events of Calcutta of nineteenth century was of the Bengal United Service Club that sold off to the government. The design for the building was innovative in that it sought to catch any breeze that there might be and distribute this throughout the building. The design was in the shape of a Maltese Cross.

On the ground floor, the four arms of the Cross housed the billiards room, the administrative offices, the library, and chambers for the accommodation of temporary visitors. The octagonal space, from which the arms of the Cross radiated, was used as the members' bar. On the first floor, the arms of the Cross were occupied by the dining room, the kitchen, the card-room and the reading room. The space above the octagonal bar was open to the roof and provided an entrance lobby at the top of the main staircase to the public rooms. GSI holds its Central Library in the building [Front cover page]

To add spice to the subject a few sketches have been incorporated to understand the wits of those who had come a long way to unravel the treasure of this country. Accepted, the British hired these great geologists to unearth the hidden valuables from this country to add to its business and economy prospect but upon arrival they turned to be a part of the Land, exhausted themselves by betting even sacrificed their lives. This is attested by their activities and programmes taken and fought with their government to materialise for the benefit of the people and the country. India has gained a lot and Indians have been prospered, enlightened, civilised and educated.

GSI Through Lenses Antiquity Revisited

The world of geology has been enriched with some great discoveries and additions of some concepts and nomenclatures. Attempts have been made to script all these stories by digging out the photographs. Photos are not only the testimony of the subject of the time but also speak a lot about the area, the environs, the sufferings, the amuses and the worker. It is our duty as torch-bearers of this 163 year old great Organisation to dig into the past for lighting up the future.